THE

ELECTRICAL REVIEW.

Vol. LIX. JULY 27, 1906. No. 1,496.

ELECTRICAL REVIEW.

Vol. LIX.] CONTENTS: July 27, 1906. [No. 1,496.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

1906 Edition

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,

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THE IMMEDIATE PROSPECTS OF THE MOTOR-'BUS INVESTOR.

It is not in the minds of many to throw sincere doubts on the final success of the self-propelled omnibus. Most of us with a smattering of engineering knowledge were sure of that before the boom, everyone without a symptom of that kind of learning is absolutely convinced of it now, the inventor has never doubted at all, the opinion of the company promoter may be seen in the newspapers upon most days of the week, and the specialist has to make a living.

We repeat our opening statement; nobody, including those who know all about the matter and the few who do not, really thinks that the mechanically-driven 'bus can disappear prematurely now that it has taken such a grip of the streets of London and provincial towns. Nothing mechanical which gets to such a stage of development ever does. But it will be a Juggernaut rolling to triumph over the self-flung bodies of its worshippers; just as Juggernaut rode in the carriages of our boomed railways, and in a milder way in the cars of our electric tramways; just as he will continue to emerge from his temple, for who knows how many centuries, until the ignorance of our investing masses shall cease to be inflamed in a passion of belief, and until the greed of large dividends shall cease to blind the prudence which they exercise in other affairs.

An engineering correspondent contributes to the commercial supplement of the *Times* for June 18th a broad and chastening article, which conveys in little more than a column as clear a view of motor-'bus prospects as many would fail to give in three times the space. He points out that, within the last few months, 32 *new* companies have been floated, with an aggregate capital of 6½ millions, and he suggests that there is not enough traffic to keep the receipts and the profits up to the estimated figures. The estimates of both have been based on insecure grounds, and the probabilities are that the depreciation and maintenance charges will increase in an unpleasant manner. Then there is the very serious question of the greater suitability of the petrol motor, for which almost every venture has plumped, while the steam motor may prove the wisdom of the Darracq people by taking the place of its rival.

Of course, we must remember that, even if steam or any other kind of motor does come out on top, the existing motors of other types do not cease at once to be of any commercial use to their owners. They can live out their life—whatever it may turn out to be—just as though they were alone in the field, and the actual loss to the owners will be the value of the capital represented by the difference between the life of the petrol motor (including the chassis) and the greater life of the better motor.

Workshops for Devon and Cornwall points out in his annual report that the most notable industrial development in his division is the continued increase in electrically-driven machinery.

Yet Winnipeg hopes for a rapidly increased population, and that the providing of power at low cost will induce manufacturers of all kinds to locate in the city.",

They can live out their life usefully so long as they are not dangerous or an intolerable nuisance, as a well represented section of the community would be glad to prove them, and for that matter, all other motor-driven vehicles, including electric tramcars. The heavy total of casualties brought to public notice soon after the fearful accident at Handcross, added to the serious agitation headed by Sir Theodore Martin, which has attracted the attention of both Houses of Parliament, has done a great deal to help the anti-motorist in his unsympathetic crusade of destruction; and there is no gainsaying that apart from hysteria there is a great deal of truth in all the unfavourable criticisms which have been heaped upon the motor-'bus irrespective of quality or degree within the last month or two. The public has several by heart, as, for instance, that the drivers are reckless, untrained, youthful, and underpaid: that the machinery may break down or catch fire at any time: that the brakes are unreliable; that the noise and smell are so bad that whole streets of good houses are being deserted; and that catching a motor-'bus is like hunting the snark.

The Commissioner of Police has had his pace forced by Public and Parliament, and has given the companies warning to amend their noises and stinks without further delay, and we may be sure that there are enough horse-'bus, tube, cab and tramway interests alive to keep the motor-'bus companies sufficiently harried for the good of everyone else.

How far the companies will have to go in order to prevent noise, vibration and smell none but the expert can tell, but the notion gains ground that nothing less radical than the replacement of the whole chassis can be effective in some cases. In any case, investors must feel that heavy drafts will have to be made on revenue to put things right, and that the cost of maintenance, supervision and driving may be increased after all. Anything in the nature of a failure is to be deplored, and we trust that nothing of the kind will occur, but a considerable pooling of interests is to be expected and welcomed.

We would not wish that motor-'bus enterprise had tarried until the motor better than the petrol-engine pure and simple had arrived. If that rule were general there would be no true enterprise at all, and no better "anything" for that matter; but we do agree with the writer to the *Times* supplement that everybody has taken the petrol motor too much for granted, and we cannot close these remarks more aptly than by quoting his final sentence:—"There is now more than enough money at stake, and the public may well let existing concerns first work out their own salvation before venturing more capital in the great motor-omnibus experiment."

The Personnel of the Power House.

Readers of Mr. Kipling's poems will remember the interjection into the soliloquies of the Scotch marine engineer of the question, "But, what about the man?" Electrical engineers who are anything but grey-headed can call to mind advances more rapid than those from low steam pressure to "thirty knots an hour, thirty and more." Side by side with the tendency towards higher pressures for generation and distribution, generating sets have increased in size, while the sub-station of to-day often exceeds in capacity the generating station of only a decade ago. Judging by recent progress, it is surely no extravagant speculation to contemplate a generating station having a peak load capacity of 150,000 to 200,000 KW.

Speculation as to the staff of such a station becomes a matter of interest. The query "what about the man" at once arises. As to him we have no doubts whatever. We may however, perhaps, be pardoned for mentioning the matter chiefly from the point of view of the staff on shift duties. Of course the chief engineer should be well nigh omniscient, and therefore does not need to be clearly defined. The subordinates should however be specially selected and trained for their several duties. The tendency in this direction has for a long time been marked by the employment of mains superintendents. Within the station further classification seems necessary, and a clear defining of duties between the steam and electrical sides. As the prime duty of an electricity supply works is to supply electricity, the shift engineers should all be electrical engineers, fully versed in electrical matters. We do not think, however, that it should be necessary to make them responsible for all the minutiæ of steam raising. At present the average station engineer is fully competent on the electrical side, but his thermo-dynamics are weak. That is inevitable when one remembers that his college days, if he was then aspiring to be an electrical engineer, were mainly devoted to physics and electricity. His courses in steam and mechanical engineering were at best but brief. Therefore the shift engineer in the big power house of the future will, unless college courses are prolonged, still remain intellectually the equivalent in this respect of his *confrère* of to-day. After all, his prime duties must be electrical, and compared with continuity of supply a few tons of coal more or less consumed on his shifts are to him a matter of comparative indifference.

Not so however to his chief, who will regard the second decimal place as a rough approximation in computing costs per unit, and working to the third and fourth places will jealously grudge each hundredweight of coal wasted. Such a chief should demand a separate steam raising staff, made up of one chief assistant in charge of the section who would do no shift duties, and three assistants, *i.e.*, one per shift. The assistant steam engineer on each shift should be responsible for providing to the engineer-in-charge all the steam required, and should be responsible to the chief steam raiser for its economical production. He should take indicator cards once on each shift, and keep an exhaustive record of all that took place in his department. For instance, where each set has a separate condenser the steam condensed in each should be measured with a water meter on its way to the hot well. This figure should be compared with the load on the set. Recording vacuum gauges should be installed for each condenser, and the consumption of the motors driving the auxiliary sets metered and noted at, say, two-hourly intervals. Where superheated steam is used thermo-couple or resistance pyrometers should be installed at the end of the superheater and at each engine stop-valve. Here, again, records should be taken automatically, preferably at a small switchboard set aside entirely for the pyrometers. The taking of flue gas temperatures pyrometically and the installation of carbon dioxide recorders would be an obvious necessity. The boilers would require much attention, and, to begin with, the feed water supply to each should be metered. Coal analyses and fuel calorimetry would be among the demands falling on the chief of the steam department.

It will be at once urged that this will virtually imply the continued operation of the whole of the steam raising and steam consuming plant under permanent test conditions. This we concede. There are such wide differences between special tests at makers' works before delivery and the steam consumptions of the plant under station conditions, that it is only by duplicating test conditions in permanent working that we can expect the mammoth stations of the future to work at their maximum economy.

The minutiæ of steam raising are worth studious attention, and in the large station of the future we expect to see a section of the staff definitely assigned to these duties.

INDUSTRIAL POWER SUPPLY FROM MUNICIPAL STATIONS.

By F. H. CORSON, A.M.I.C.E.

The rapid development of the industry, if such it can be called, of the electrical generation of power has within recent years so far outstripped the most sanguine expectations that engineers are called upon to meet conditions and to solve problems which until the present were quite out of the range of practical politics. Adaptability, cleanliness, facility of transmission and application and ease of measurement have combined to single out electrical energy as being the most desirable form in which to obtain and distribute power for industrial operations which have formerly been performed with the aid of other and older agencies. The attributes above mentioned are, however, not sufficient in themselves to justify the adoption of the new and the supersession of the old in so essentially commercial a sphere as that of the use and mode of application of power. It must be proved that methods involving the use of electricity, while possessing these advantages, also show the additional qualification of at least equal cheapness. This demand for electrical energy at a low figure has called into existence the various power schemes which are attracting so much attention, and exciting, more particularly in municipal circles, such uncompromising hostility. The over-confident assertions of the promoters of such schemes as to the favourable terms to be offered to large power users have been met for the most part by counterclaims on the side of the local authorities that the latter were in a position to make equally advantageous offers, and at the same time to afford greater security to those availing themselves of such overtures. In some cases scales of charges to large consumers of power have undoubtedly only been drawn up with the immediate object of defeating the power companies' Bills, possibly also with the sincere hope of the municipal engineer that his terms may not be accepted. From the point of view of the extreme advocates of municipalisation, they have been eminently successful. The position of the municipality face to face with this problem is a somewhat difficult one. Most of the plant belonging to the local authority has been purchased at a cost which would now be prohibitive. The money represented by this plant has been raised by loan on the security of the rates, and possibly only something like one-third, if so much, has been repaid. The works have, in many cases, been erected on valuable land, at a heavy cost, and are occupied subject to the payment of heavy rates. Large developments were entirely unforeseen at the time of their commencement, and the site was consequently unfavourably chosen from the point of view of the economical generation of power to any large amount.

It is undeniable that a large concern, equipped with the most modern and efficient plant at a low capital cost, and occupying a position well adapted for the supply of fuel and water, should, if allowed to enter into competition with the municipal undertaking, operate most seriously to the disadvantage of the latter. It is, therefore, only natural that the municipality should seek the weightiest arguments to advance against the claims of the rival enterprise, and the course of offering equally good terms is certainly the strongest, implying as it does that the need for the proposed scheme does not exist, and that nothing is gained, while something is certainly lost by permitting it to take practical form. In the present position of most municipal electricity undertakings this course is apparently a perfectly justifiable one.

Leaving out of the question the generation of power for electric traction, the bulk of the supply is required for the purpose of lighting, which naturally makes a demand upon the plant for only a short part of the day, and this when most of the industrial operations have ceased. The price charged for lighting has accordingly been fixed sufficiently high to permit of the plant and mains standing idle during the greater part of the time, and still to make adequate provision for covering the revenue and capital charges.

It is obvious that to work the plant for motive power purposes during the time when it would otherwise be out of use, will involve no appreciable increase in the capital charges, and practically no addition to some items of the revenue charges. The wages, repairs, and fuel accounts will be increased somewhat, but by no means in proportion to the work turned out, and any revenue which will more than cover these extra charges, will show a profit. Such is the usual line of argument, and within limits the reasoning is sound. Unfortunately, however, it is to be feared that in many cases these limits are not appreciated, and it is not recognised that a policy which may be satisfactory and advisable under certain conditions will fail of justification when the conditions are modified.

It is proposed to investigate the reasonableness of such an attitude, and the financial soundness of some of the scales of charges which have been adopted in this connection. It may be instructive to assume an actual case, taking as a basis the average figures of moderate and large sized stations (upwards of 3,000 KW. capacity) in the United Kingdom. Roughly speaking, the mean capital cost per kilowatt installed is something like £70. Taking interest on this amount at 3½ per cent., we have a total capital charge of 6½ per cent., or, say, £4 10s. per KW. installed per annum.

For the purpose of illustration it may be first assumed that the whole of the plant is in use, and that no stand-by other than that implied in the overload capacity is provided. A motor load in most industrial centres comprises a 56-hour week for 50 weeks, giving 2,800 hours in the year.

One kilowatt capacity of plant then on such a load can generate 2,800 units per annum, the capital charges on which amount are £4 10s., or ·38d. per unit. Allowing a discrepancy between units generated and sold of 15 per cent., a favourable figure when compared with the results achieved by most stations, the capital charge becomes ·44d. per unit sold.

Further, as no engineer would consider it well advised to load all his plant up to its full rated capacity, without any provision for stand-by, it may now be convenient to assume the existence of 20 per cent. of spare plant. This will advance the capital charge per kilowatt of earning capacity of the station to ·51 or ·52d. per unit.

Coming now to the scheduled scale of charges adopted by many municipal undertakings, we find that, for a demand of such an amount as we are contemplating, viz., a load of 400 or 500 H.P., giving from 750,000 to 1,000,000 units per annum, the price is fixed at from ·55d. to ·7d. per unit, and is usually in the neighbourhood of ·6d. It is thus seen that a margin of ·1d. to ·15d. is allowed to cover the cost of generation and any additional cost incurred in connecting up to the supply. This figure is, of course, quite impossible of realisation, and the economies resulting from the possession of a large day load at such a price could never be so great as to permit of a profit being made. Accordingly, any hopes which may have been cherished of the profitable supply of energy in bulk for industrial purposes from such stations must be abandoned, and the lighting consumer must be relied upon to furnish that part of the revenue which is applied to the defrayment of the capital charges.

The wisdom of offering the supply on such terms must depend on local considerations. So long as it is certain that the demand on the plant for lighting purposes will be greater than that for power in any district, the latter demand may be regarded as an extra source of revenue and is to be sought at any price which will yield a margin of profit on the cost incurred in generating and distributing the energy to meet it.

In an industrial district where the offer of cheap energy is likely to meet with a ready response, and a large demand may be anticipated, the soundness of the proposal may be called into question. Broadly speaking, it is essential for soundness that the motor load thus obtained shall not be such as to entail any addition to the generation or mains capital in the provision of additional plant to deal with it. It must also be remembered that in most industrial centres the lighting and motor loads overlap for an hour or so each day for a period of about 10 or 12 weeks in each year, and the plant either with or without its overload capacity, must be capable of meeting this requirement.

The adoption of such cheap rates, even within the prescribed limits, lays the undertaking open to the charge of unfair dealing, and of penalising the lighting customers for the benefit of the power users. It is difficult to explain to

the untechnical mind that the effect of the motor load is to reduce slightly the cost to the lighting customers, that consequently such a load is desirable in their interests, and that the only means of obtaining it is to offer the energy for this purpose at almost the cost price of generating it.

A modern plant installed on economical and efficient lines may reasonably expect to generate and distribute electrical energy at a price which will compete with other power agencies, and at the same time yield sufficient profit to meet the capital requirements, but this by no means applies to most present-day municipal undertakings.

A MODIFICATION OF THE CABLE ZERO CONDUCTOR RESISTANCE TEST FOR SUBMARINE CABLES.

By G. B. WINKFIELD.

The earth current on a laid cable varies incessantly in an extremely irregular manner.

When a battery is applied to a long cable with its distant end earthed, a considerable number of seconds elapse before the resulting current becomes steady. For instance, it has been found that on a long section of cable having a K R of 9·2, at least 30 seconds elapse before the testing current reaches a moderately steady value.

In the meantime, the E C is varying irregularly. The most that can be done under these circumstances is to observe the cable zero, apply the battery for the minimum time admissible, observe the balance deflection, earth the cable for the same minimum time, and observe the cable zero again. The mean between the two cable zeros may be assumed to equal the cable zero at the moment of balance.

If the full sensibility of the galvanometer is preserved during these readings, everything possible has been done to eliminate the E C effect from the C R readings.

The following is the actual routine suggested for testing a laid section of cable for C R :—

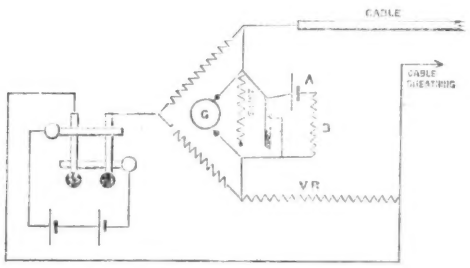


Diagram of Connections for Test.

Usual bridge connections, with the addition of a circuit across the short-circuit key, consisting of a battery A and a resistance B; the value of this resistance should never be less than five times that of the galvanometer. The number of cells and direction must be adjusted to suit the E C. Three cells is usually the maximum ever required. For B use a duplexing resistance of about 200,000 ohms adjustable to 1,000 ohms. Place in the variable arm of the bridge a resistance equal, as nearly as can be estimated, to the cable under test: open the short-circuit key, and, with the galvanometer at its greatest sensibility, adjust the battery A and resistance B, until the E C is compensated and the spot returns approximately to zero.

Take a series of readings with battery "off" and battery "on" alternately, allowing the proper charging intervals between each two readings.

Call the deflections to the left of zero −, and to the right of zero +. Start and finish with an "off" reading. Halve the first and last "off" readings, then add these to the remaining "off" readings, and obtain the sum total. Obtain the algebraic difference between this diminished sum total and the sum total of "on" readings. To do this, always subtract "off" from "on," never *vice versâ*. Divide this difference by the number of "on" readings.

This gives the true mean difference between "off" and "on." Find out how many ohms + or − this represents, by observing (while battery is on) how many divisions + or − an alteration of 10 ohms in the variable arm makes.

If the E C is too variable to do this with accuracy, disconnect the cable and substitute in its place a resistance equal to that of the cable; remove the battery A, leaving the resistance B joined up across the short circuit key; then with battery "on" see how many divisions an alteration of 10 ohms in the variable arm makes.

Example Test.

	Battery "off."		Battery "on."
1st ...	+ 10		+ 32
2nd		+ 15	+ 37
3rd		+ 20	+ 55
4th		+ 50	+ 82
5th		+ 70	+ 70
6th		+ 40	+ 40
7th		+ 20	+ 20
8th		− 10	+ 5
9th		− 20	+ 0
10th		− 30	− 20
11th ...	− 50	+ 155	+ 321 sum total
	2)− 40	− 20 half first and last	+ 135
	− 20	+ 135	10)+ 186 difference
			+ 18·6 mean difference

Resistance in bridge V R, 7,020 ohms.

On increasing the V R by 10 ohms, the spot moved 50 divisions to the left, so + 10 ohms = − 50 divisions, ∴ + 1 ohm = − 5 divisions.

The difference of + 18·6 divisions between the battery "off" and the battery "on" readings, observed during the test, would be reduced to 0, if $\frac{18{\cdot}6}{5}$ = 3·72 ohms were added to the V R of the bridge: because these 3·72 ohms would, by calculation, make the spot move − 18·6 divisions, and thus exactly neutralise the existing movement of + 18·6 divisions.

The resistance of the cable, therefore, is equal to 7,020ᵒ (the resistance in the bridge V R) + 3·72ᵒ = 7,023·72ᵒ.

It will be noticed that the method adopted for meaning, is equivalent to taking each set of three readings (two "off" readings, and the "on" reading in between them) separately, meaning the two "off" readings, subtracting this mean from the "on" reading, and then meaning all these differences.

In the example test quoted, examining the differences in each set of three readings, one finds that the maximum difference is + 25 divisions, or 5 ohms, and the minimum difference is + 10 divisions, or 2 ohms. The difference between these maximum and minimum differences is a measure of the reliability of the test. The less the difference the greater the reliability.

The following advantages are claimed for this method :—

1. Testing time used to the maximum advantage, because every reading is made use of and contributes to the final result.

2. The maximum sensibility of the galvanometer is always available, whether the earth current be strong or weak.

3. Small experience is necessary; exact time keeping and scale reading are the only essentials.

4. The results obtained are more consistent and accurate than by any other method.

[The author, writing from H.M.C.S. *Iris*, Auckland, states that this test has been in weekly use for two years on all the Pacific Cable Board's cables, and has given more satisfaction than any test hitherto published, giving constant results under all conditions, even in the hands of untrained observers. The method was independently devised by himself in June, 1900; he is not aware of any similar test having been previously published, but if it has been, he would be glad of particulars.—Eds. E.R.]

THE RATING OF LIGHT RAILWAYS, AND THE LICENSING OF CARS AND CAR-CREWS.

The Tramway and Light Railways Officials' Association met in Edinburgh on June 11 and 12, and the proceedings were opened by Mr. H. England, several points in whose speech are worth more than the passing comment which we can spare. One of these points was concerned with the rating of Light Railways; another, with Inland Revenue licences for cars used on light railways, and a third touched the licensing of employés and cars under the Town's Police Clauses Act of 1847.

Our readers have been informed duly when the Courts have given decisions bearing on these matters, but such decisions gain in significance when viewed in company, and we feel more than ever that Mr. England, as representing the Wakefield and District Light Railways, and the B.E.T. as represented by the Yorkshire (Woollen District) Electric Tramways Co., have earned the sincere thanks of all owners of light railways for having had the acumen to discover that they were accepting without question liability for payments for which there was no legal jurisdiction, and doing things which were in excess of their statutory obligations. Thanks are due especially because discovery was followed by adventure carried out with the boldness and pertinacity which are not always the supporters of honest conviction. Thanks are due finally, and for more than all else, because success has crowned enterprise.

We refuse to believe that the motive underlying the comparative absence of discussion of these points at the meeting is of the same nature as that which has been known to prompt people to leave a place of worship before the collection—in fact, we feel sure that there is an entire absence of motive; but we can do no less for Mr. England's cause, which is not confined to his own district, but involves the interests of the whole of the legal light railways in England, than to say with him, it is not fair to expect one company or one corporation to pull the chestnuts out of the fire while others look on and eat. . . . We are entitled to the support and financial assistance of interested parties. Surely that is not an attitude to which anyone can take exception.

Briefly, what Mr. England has done is this: Claiming that light railways are to be rated like railways on one-fourth of the assessment of the track, and all that appertains thereto, they were fought by the Borough of Wakefield. The magistrates, as magistrates would, decided against the Light Railway Co., but the appeal was granted by Judges of the King's Bench. Possibly the fight will be carried higher, and that is one of the reasons for which co-operation is sought.

Claiming again that licences are not required for light railway cars any more than for railway carriages, Mr. England refused to take them out, and the Commissioners seem to be in such a fix that they are driven to declare that if cars are not licensable as such, they must be regarded as private carriages "and attract the higher duty."

Although there are exceptions, the general rule is for cars and car-crews to be licensed both for tramways and light railways by the local authorities under the Town's Police Clauses Act (1847).

Whether by accident or of set purpose, the Yorkshire (Woollen District) Tramways did not take out licences in respect of their light railways as required by the Dewsbury Corporation, and they were fined. They appealed, and on December 20th last, the Lord Chief Justice, Justices Kennedy and Ridley concurring, upheld the appeal. "The Court could not come to the conclusion that that which was in substance a railway was to be subject to the provisions of the Town's Police Clauses Act in regard to the licensing of *hackney carriages*. The absurdity of the thing was too great."

We have emphasised the words "hackney carriages" as bearing very closely on the contention of the Commissioners of Inland Revenue with respect to licences under the Light Railways Act.

After such a particularly strong judgment, it is hardly to be supposed that the Dewsbury Corporation or any other Corporation will want a further decision in so far as light railway cars are concerned; but Mr. England would refuse to licence for *tramway* cars and crews as well. That, at present, is the wider issue, and it is the positive duty of tramway companies to see it through.

It is a nice question how far any local authority owning and working tramways will be willing to assist.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Manufacturers Selling Direct to Consumers.

I note with interest the letters respecting manufacturers supplying direct, and can only express surprise at the fact that this injustice to contractors has flourished so long. I have frequently met the same direct tradings in various forms, particularly with fittings, being situated within 30 miles of Birmingham. It is no unusual thing to be informed by a client whose wiring is nearly completed that he can get fittings direct from Messrs. So-and-So. He has a nephew who is office boy or something there, or occasionally he met Mr. So-and-So, who has interest in the fittings trade, and he is going to advise as to the most suitable fittings. One frequently finds this friend (to the client) is a manufacturer who sends travellers to call on oneself for orders. Should a few accessories be omitted, or defective (blocks, screws, bad lamps, flex not permitted by the supply authority, and so on), I have the pleasure of supplying these few necessary things from a stock which is evidently only for their convenience in time of emergency. The cycle retail trade has been ruined by this same thing. Manufacturers now openly sell direct, and give exactly the same terms as to the trade. I should like to hear manufacturers' views, and suggestions from contractors.

Cables.

Re Poplar Inquiry and B.T.-H. Lamps.

As the impression is prevalent that the lighting installation mentioned at the above inquiry is in connection with the Borough of Poplar electricity undertaking, I beg to inform you, with the request that you will give this letter publicity, that the Board of Guardians have their own electric lighting installation at the Poplar Workhouse, and it is to the latter that reference was made at the Local Government Board inquiry.

J. Horace Bowden,
Borough Electrical Engineer and Manager.

London, E.
July 20th, 1906.

Electrical Nomenclature.

I wish to protest against the use of the letters K.V.A. instead of the letters KW., signifying the kilowatt, by English engineers. The kilovolt-ampere may be proper for a foreigner to use, since he knows no better, but there is no reason for British electrical engineers to introduce this term, when we have a much shorter and equally well understood term. If foreigners cannot remember that a volt × ampere = a watt, then it is time that we should forget that there is a volt or an ampere, and invent terms of our own.

Zero.

[Our correspondent, whose enthusiasm for uniformity of nomenclature is praiseworthy, has, unfortunately, gone astray on this point. Kilowatt and kilovolt-ampere are synonymous terms with regard to direct current, but are generally quite different and distinct when applied to alternating currents. To put the matter briefly,

Kilowatts = kilovolt-amperes × power factor.

—Eds. E.R.]

Rail Corrugation.

This is a rapidly developing problem which has to be faced by tramway engineers.

In my opinion "rail corrugation" depends upon a number of important factors taken "collectively."

Rail corrugation being an alteration of form or shape, one factor which will obviously affect it, is the "form" of cross-section. The "weight" of the rail is a second factor. Considering the rail by itself, the "durability," long life and property of resisting suddenly applied loads (and, consequently, "harmonic" vibrations) depends upon four chief factors, viz., the (*a*) "chemical composition"; (*b*) the weight; (*c*) the form of cross-section; and (*d*) the amount of "rolling" to which the rail is subjected during process of manufacture.

In the past rails have been installed too light in weight; and, also, owing to the fact that Corporations and others who purchased rails by tender have, as a general rule, accepted the cheapest foreign-made rails, endeavouring to economise by saving, say, 2s. 6d. to 10s. per ton. The result is that thousands of tons of foreign-made rails (cheap material and workmanship) have been imported into this country and installed, ostensibly on which to build up a commercially stable undertaking.

The folly of it is seen everywhere around us. They made no stipulation as regards the amount of workmanship or "rolling" needed in the rails manufacture. Chemical composition is one thing, but a factor of equal importance is "prolonged rolling" in the rolls. This brings about an internal physical condition (molecular structure) which it is impossible to attain by any other method. This is where the cheap Belgian and other rails present a vitally weak point. With them the all-important factor of "prolonged rolling" is dodged, for time represents money, and they cannot afford time on rails which are sold at small cost.

Dealing now with the "foundation" or "rail-bed" for the rail, this is also an important factor. Rails ought to be "anchored," and although I readily admit that a solid concrete foundation is generally substantial, still, at the same time, it forms too stiff a road bed, tending to a noisy running and excessively undue wear and tear (consequently heavy maintenance expenses) on the "rolling stock" and "permanent way" in general.

To my mind, the most practical foundation is the longitudinal wooden sleepers, laid or partially embedded on a substantial substructure, either of "concrete" or ballast, and I feel confident that it is only a matter of time before this method will be generally adopted in good tramway construction.

This will to a great extent remedy the defects of "rail corrugation." What is essential from every point of view (both practical and commercial) are well rolled rails of heavy weight, and suitable chemical composition, laid on a good foundation of longitudinal wooden sleepers properly embedded or supported.

British manufacturers can, and will, supply a good rail fulfilling essential conditions if specified (rails can be inspected in process of manufacture), but this can only be done by offering a fair price so as to get a combination of good material and labour. I have several times (in articles which have recently appeared in *Electricity*) dealt with "permanent way construction, rail foundations, methods of rail manufacture, &c.," and have incidentally mentioned "rail corrugating."

In my opinion it is induced by the collective opportunities offered by several factors, and can only permanently be prevented by eliminating the defects presented by several such factors. A cheap flimsy rail on a good foundation, and conversely a good rail on a defective foundation entirely nullify the effect to be attained by a collective substantial structure from all standpoints. The "characteristic periodicity" Mr. Warner mentions is not new, as I have several times referred to it, under the heading of vibratory "harmonics." I have no faith in Mr. Warner's suggested remedy. Corrugations are induced more quickly by certain types of car truck at particular high speeds. Single truck cars which "oscillate" considerably, induce corrugations much more quickly than the large double bogie truck cars. There is a remedy for rail corrugations, and it can be attained by following the ideas as set forth in this article. Corporations and others are now reaping the benefit of cheap rails and defective unsuitable foundations and structure. All the "rail grinding" in the world will not permanently remove the corrugations, it is a waste of time and money. The only permanent method is to rip up the roadway, sell the rails at so much per ton, and properly reconstruct it.

Wm. R. Bowker.

Manchester.

Gas v. Electricity.

In answer to Mr. Mackenzie, the much abused (jerry) wiring contractor deserves all the abuse he gets, and more. Is he not the man who is mostly responsible for the run on gas which has lately taken place almost everywhere? The contractor I refer to in my article is no other than Tom Jones, and I am extremely sorry that Mr. Mackenzie should have hinted that I was ignorant enough to imagine that "no contractor is worthy of being classed as a member of the electrical profession, and that honour should be alone conferred on resident and central station engineers and such like." I may go further and state that I share the general knowledge that some resident and central station, yea, even "consulting" engineers, are not engineers at all. These are, in fact, as great a discredit to the calling as is Tom Jones, who wires a house with bell wire when he gets the chance.

Tantalum lamps stand well in Cambuslang, which, I understand, is far from being the case in Glasgow. This, however, cannot be wondered at when such a large town has to be supplied on the three-wire system. Perhaps when the three-phase feeder scheme is more advanced Glasgow people will be able to use Nernst or Tantalum lamps with some success. I cannot understand how anybody but an idiot would worry a contractor to bring down the first cost of an installation by 50s. *if* the contractor had *proved* that by spending £12 10s., or even £20 instead of £10, his *saving* in current would, in a very short time, pay for the whole of his installation. Such cases must be very rare, one would think. If Mr. Mackenzie wants something to fight the gas man with, he should obtain the book by Mr. Rockley from Messrs. Jacomb Bros., 2A, Wingfield Road, Stratford, London. He will find this very refreshing.

I have always tried to carry out Mr. Mackenzie's suggestion, both by encouraging good contractors and by issuing circulars to intending consumers. Also I have done my best to get wiring by Tom Jones altered. For, in spite of circulars and continued warnings, Tom Jones has got to Cambuslang, and the gas man is ever hovering around his jobs.

If contractors are not partly to blame, how is it that one sees (even in large installations) in Glasgow lamps as black as your hat? Is it because contractors and the electricity department have not taken the trouble to tell their customers the consequences of using lamps in this condition? If so, it is no wonder that the gas department are doing this for them, and are contaminating the shops, air and food of the people with the filthy gas light.

A. J. Abraham.

Electricity Works, Cambuslang,
July 23rd, 1906.

Inaccurate Electricity Meters.

I venture to think that the chief reason for Mr. Fedden's complaint of the lack of comment is that the question of inaccurate electricity meters is a most thorny matter to enter into any discussion about.

The fact of the whole matter is that the "proper or legal procedure," as at present laid down by the Board of Trade, is unfitted to deal in a satisfactory manner with the practical every-day needs of electricity suppliers and consumers. The position of the meter manufacturer is not altogether an enviable one either in this matter, as he is ever being pressed on the one side for cheaper meters (a matter of a few pence per meter will decide the fate of a contract), and from the other side the specified conditions as to maximum error allowable, starting currents, &c., are growing more stringent. This is especially the case in the London

area, where the autocratic L.C.C. steps in as between supplier and consumer on the one hand, and the meter manufacturers and the supply companies on the other.

What is the remedy? Personally, I think the legal limit of 2½ per cent. is altogether too fine; I should say, raise the *legal* limit to 6 per cent. from tenth to full load, and 10 per cent. on twentieth load for meters below 10 amperes. This would not prevent station engineers specifying for *reasonably* closer limits, any more than the present 2½ per cent. limit prevents certain station engineers specifying for 1½ per cent. and other things. However, that matter is one easily settled between the manufacturers and their respective customers, the station engineers.

The real advantage of raising the limit, as I advocate, would be that a meter within 6 per cent. would be a "correct meter," and its dial reading would be "conclusive evidence, in the absence of fraud, of the value of supply." This would prevent such absurd cases as that of a meter with 2½ per cent. error being "correct," and another meter with 3 per cent. error "incorrect."

This raises another question, and one, I fear me, little thought of, and that is, for how long will the modern meter retain its permanency of adjustment? For the permanency of calibration has an important bearing in determining the limits of initial accuracy.

Robert Hornby,
Meter Sales Manager,
The Electrical Co., Ltd.

London.

Electricity in Collieries: Information Wanted.

I should be very grateful to any of your readers who would answer the following queries:—

1. When was electricity first used for colliery work; I think I remember Mr. Corlett (Wigan) stating in a lecture that it was first used for lighting at Earnock Colliery, Hamilton, but I am not quite certain of the date?

2. When was it first applied for power at a colliery, type of motor used, shunt or series?

3. When was three-phase first used at a colliery, and for what purpose?

4. Are there any single-phase machines at work at any colliery?

Power.

Wiring with Flexible.

A question which I think most important to-day, is that of cheap wiring to compete successfully with gas. Much has been said for and against conduit and casing systems, but personally, except under damp conditions, I am inclined to favour an uncased installation, by using extensively, as on the Continent, flexible wiring run upon suitable insulators, all being face work. The flexibles would be coloured to match the wall papers, &c., the same being of first-class quality, 70/40s size, double rubbered and heavily insulated.

This method, I contend, will be far safer than a wood casing job, as on a short circuit developing on the leads, the flexible would burn itself clear and drop by its own weight into the area below, and would not be held together as in the method of wood casing, causing an arc between the floors and the consequent great fire risk.

Please note I do not want to open up again the merits or *vice versâ* of various conduit systems, but rather to try to induce the English Insurance Companies to accept this proposed system as an alternative where cheapness coupled with safety is the desired object.

In a district like my own, hundreds of lights could be obtained, especially working men's houses, shops, &c., if the price per light could be reduced to the region of 5s.

The installation mains I would run on porcelain cleats, well backed off the walls by paraffin waxed wood battens.

This question was mentioned on several occasions at the Convention of the Municipal Electrical Association held in London recently, and received favourable consideration.

I should be glad to hear the views of other municipal engineers on this small but important matter.

R. B. Leach, A.M.I.E.E., A.M.I.M.E.

Farnworth Electricity Works,
July 17th, 1906.

Electricity for Lighthouse Illumination.

Our attention has been called to the notice in your issue of 13th inst. regarding the use of the Kitson light in lighthouses.

We ask you, in fairness, that you will give us space to say that the notice contained in the *Times* is substantially correct. That notice did not say that the Kitson light had superseded the electric; it stated that the Kitson light had been installed at the Lizard and other lighthouses. This information is absolutely correct. Further, the information that the Kitson system was used during a fog at the Lizard came from one of the lighthouse employés.

As to the question whether the electric light as installed at the Lizard is or is not superior to the Kitson system during a fog, this is not a matter of opinion, but a matter of fact. Any lighting engineer knows, whether he be an electric light man, a gas man, or an oil man, that the blue rays which preponderate in the electric arc will not penetrate the fog for any distance, whilst the red and yellow rays do, and as the Kitson system is rich in these, it stands to reason that it should be a better illuminant during fogs than the electric arc. The same is true of the oil-wick lamp and an ordinary gas jet.

Permit us to quote the opinion of one of the greatest lighthouse authorities, Mr. John B. Wigham, of Dublin, who, in a paper read before the Royal Society of Dublin, said:—

> Recent experience has shown that the electric light is not the best light as a lighthouse illuminant, sea captains and others competent to judge having testified that it is misleading in clear weather and absolutely useless in foggy weather. The Trinity House appear to have concurred in this view, for they have not established any electric light since the date of their report on the South Foreland experiments. The claims on the electric light as a lighthouse illuminant having thus been disposed of, the question arises: Can we find a light with the intensity of the electric light without its defects for lighthouse purposes? The new light, which I am about to describe, is one which seems to possess that desideratum; it is also rich in the red and yellow rays, in which the electric light is deficient, and it has besides the necessary volume which contributes to the power of making itself visible in foggy weather, and has also a uniform steadiness not attainable by the electric arc light. This light is an American invention, and is called, after the name of its inventor, the "Kitson" light. It is really a gas light, though made from cold petroleum, and possesses those valuable properties which originally commended the gas system to Prof. Tyndall and the Irish Lights Commissioners.

The Kitson Light Foreign Supply Co.
J. Chubb, *Manager.*

Willesden,
July 23rd, 1906.

[Our note was quite correct; the Kitson light was installed at the Lizard merely as a stand-by. We refer to this matter in our "Notes" columns.—Eds. E.R.]

Zinc v. Lead for Storage Batteries.

During the last few years many efforts have been made to replace the lead accumulator for traction purposes, and thousands of pounds are yearly expended with this idea in view, but beyond a few laboratory cells, on which a glorified report is given, one hears nothing further about these new inventions, which—according to the views of the inventors—are to bring the career of the lead accumulator to an end. Edison, with his nickel cell, has wellnigh frightened lead accumulator makers out of their wits, and there are still many people who are waiting for the development of this class of cell before they take any further interest in electric accumulator vehicles; Edison himself after some years of vain work on these nickel cells to bring them up to a commercial standard, has turned his attention to cobalt, in the hope that this metal will realise his hopes.

With regard to zinc batteries, some good results have been obtained with this kind of accumulator, and I think one of the best, which actually has been placed on the market, was the Leitner cell; some of these cells have stood over 50 discharges, which to my knowledge no other zinc accumulator has done yet. Mr. Leitner constructed, moreover, batteries of no small dimensions. But even these cells were of little use for traction purposes, owing for the most part to the enormous polarisation and difficulty in obtaining an even zinc deposit after each charge. Local action took place very little. The Zedecco cell inventor now

claims that he has stopped the local action entirely, and that an even zinc deposit is obtained by agitating the electrolyte by means of compressed air—a process which necessitates another operation and which is sure to increase the cost of the battery and is liable to fail; he further claims a very high oxide, which every battery maker claims. However, we take it that all these claims are facts, and that the life of the plates is long and the price of the battery as low as that of a lead battery; the one fact remains, however, that the polarisation even at a seven-hour rate discharge is enormous, and from his own figures it is obvious that the motors have either to be run in connection with resistances which absorb the higher voltage, or that additional cells have to be put into circuit if the voltage drops too far; however, both methods are unsuitable for reasons well-known to every electrician, therefore, when we look at the abstract of the test published on page 46 in the ELECTRICAL REVIEW we must come to the conclusion that only 222 ampere-hours at an average voltage of 2·4 volts per cell is useful to get a fairly even torque on the motors. The discharge limit for a zinc-lead accumulator is 2 volts per cell, and if the discharge is carried on further than that the positive plate will be rapidly destroyed and will suffer in the same way as a lead accumulator does if it is discharged below 1·8 or 1·7 at a high rate. The low charging rate given in the test verifies my experience with zinc lead cells, according to which the zinc deposit becomes very irregular and rocky, and is very liable to fall off if subjected to vibration; besides this the efficiency drops enormously at a high charging rate, but every electric carriage owner will agree that five to six hours, which is necessary to charge a lead battery at a fairly good efficiency, is quite long enough, and in many cases three-hour charges are necessary, and have to be guaranteed by the maker under circumstances. The second test appearing in the report, with a discharge rate from 50—35 amperes of a battery which weighs 17½ cwt., need not be considered at all, as the rate is too low to be of any value for traction purposes; the same refers to the recuperation, which is a direct consequence of the enormous polarisation, a matter which accumulator makers try to avoid rather than provoke, as it brings such a battery more or less on a level with primary batteries, which can only be used for small or momentary work, owing to their polarisation, and it is only too evident that people cannot wait about in the streets for their carriage batteries to recuperate.

Now as for the lead battery, the comparison given in the report dates three years back—that is to say, on batteries which were made about four years ago, when even the lead battery for traction purpose was in its infancy, and the unfairness of the comparison is therefore only too evident. But let us see what an up-to-date lead battery is able to do: the following are some figures of the Gottfried Hagen cells made in Cologne, and are taken from the makers' catalogue. These batteries, which are working in almost every country in the world, are well known for their light weight in connection with great durability and high efficiency, and the price is so calculated as even to work successfully in connection with commercial undertakings. Several large cab companies in Berlin, Vienna, Cologne, Buenos Ayres, &c., have run their cabs on these batteries with splendid profits for some time, and even tramways and shunting locomotives are working on these cells most successfully, and it will take a long time before any nickel or zinc accumulator will be able to equal or beat the record which the Gottfried Hagen Co. have established with their lead accumulators. The following figures have been taken from their traction cell list dated August, 1905, type L 18, the output of this cell being as near as possible to the output of the Zedecco cell:—

97 amperes for three hours equals 291 ampere-hours; average voltage, 1·95 per cell.

76 amperes for four hours = 304 ampere-hours; average voltage, 2 volts per cell.

Normal charging current about 72 amperes; weight of 48 cells, 18½ cwt., complete with acid and covers; average voltage, 96 volts at a four-hour discharge rate.

Actual voltage at the end of discharge, 1·8 volts per cell, or 86·4 volts for 48 cells.

Zedecco Cell.—89 amperes for 2½ hours = 222 ampere-hours; average voltage, 2·42 per cell.

About 80 amperes for four hours = 320 ampere-hours; average voltage, 2·13 per cell.

Normal charging current about 35 amperes; weight of 48 cells 17½ cwt., with an average voltage of 103·5 volts at a four-hour rate.

Actual voltage at the end of discharge about 1·5 volts per cell, or 72 volts for 48 cells.

Taking now into consideration that the contacts and collectors of the Zedecco are admittedly too weak, there would be, according to the above figures, no, or very little, decrease of weight against an up-to-date lead battery, not taking into consideration the other many disadvantages over the lead battery, as pointed out before.

B. Kuettner.

London, W.C., *July 18th*, 1906.

Meter Reading Books.

Would you please state if there is a meter reading note-book on the market. Such a book is required very much, with columns for dates, quarterly readings, intermediate readings and remarks, &c. For many reasons intermediate readings are often essential; but these are liable in an ordinary notebook to get mixed up with the quarterly readings, and so lead to mistakes when the accounts are being prepared.

Elaborately printed log-sheets, filled in with an endless number of readings that are of little value, are quite common; but when all the work is simply boiled down to £ s. d. the meter reading books are of the utmost value. So perhaps you could induce some enterprising printer to take this matter up.

O. K.

LEGAL.

SARTORIUS *v.* NORTHEY.

In this case, which came before the Lord Chief Justice and a special jury, on Wednesday last week, Major-General Harry Sartorius, V.C., C.B., of Old Swan House, Chelsea, sought to recover from Mr. Percy Northey, of Ashstead, Surrey, an electrical engineer, the sum of £3,563, by way of damage for loss sustained through the alleged negligence of the defendant in making a valuation of the electric carriages, plant and other assets of the Anti-vibrator Co., Ltd., at their works at Croydon and Chelsea. The plaintiff's case was that having been applied to for an advance of £4,000 to the company, he employed defendant to make a valuation for the purpose of satisfying himself as to the security. The defendant, who represented himself to be a competent valuer, valued the property at £5,964. On the faith of this valuation, plaintiff advanced the money, but on the company going into liquidation, the property was only valued at £963. The defence was a denial of negligence.

Mr. Scrutton, K.C., and Mr. Stewart, appeared for the plaintiff; Mr. Sharman, K.C., and Mr. Strachan were counsel for the defendant.

The jury returned a verdict for the defendant, and judgment was entered accordingly, the Lord Chief Justice expressing a doubt whether there was any case to go to the jury.

AUTO-CONTROLLER AND SWITCH CO. *v.* JOHN BARKER & SONS, LTD.

At the Manchester Assizes last week, Mr. Justice Bray heard this case. According to a report in the *Manchester Daily Guardian* it was a claim for the value of a motor and controller supplied to work an electric lift.

The plaintiffs are manufacturers of a patent controller used in connection with electric motors, and the defendants are a firm of engineers, who last year supplied Messrs. Andrews, Ltd., of Reddish, with a lift, which was to be fitted with an efficient controller. In August, Mr. Bush, a partner in the plaintiff company, was invited to inspect the lift, after it had been installed, and to advise, as it was said to be not working satisfactorily. On his recommendation the controller was removed and replaced by one of the plaintiffs' manufacture. The action was in respect of this second controller (which the defendants said was inefficient), and also for a motor and controller installed at Leeds. The plaintiffs said they gave no guarantee with their new controller, but it did its work efficiently, and the inefficiency complained of was due to a misadjustment of the valve and to the controller having been subjected to excessive current and improper handling on the part of the defendants' servants.

The Judge held that there was no proof of the plaintiffs' controller being inefficient, and gave judgment for them for £138 13s. 7d. with costs.

Taylor v. National Telephone Co.

At Wolverhampton County Court on Friday in last week, before Judge Howard Smith, John Taylor, Newgate, Pattingham, brought an action against the National Telephone Co., to recover compensation for personal injury. The question involved was whether a man employed in the erection or removal of a wire at the top of a telephone pole could be regarded as a workman engaged in engineering work so as to bring him within the provisions of the Factory Act. Mr. Shakespeare (of the Midland Circuit), who represented the company, quoted from decided cases in the superior courts to show that the applicant could not be regarded as being engaged in engineering work so as to bring the case within the provisions of the Act under which the summons was taken out. Mr. T. P. Haslam, for the applicant, was unable to resist the learned counsel's contention, and his Honour gave judgment for the respondents, with costs.

Is a Tram Depot a Warehouse?

At Walsall County Court on July 18th, Judge Howard Smith delivered judgment in a case under the Workmen's Compensation Act involving the above question. Thomas Rogers, labourer, had sought an award under the Act against C. A. Fanshawe, iron and steel merchant, of Wednesbury, under the following circumstances. The respondent bought a number of old tramcars at the Hockley tram depôt, and the applicant was employed in breaking them up for removal. While he was doing this he received an injury to his back. Judge Smith said that the contention of the applicant was that the tram depôt was a warehouse, and, therefore, a factory within the definition of the Compensation Act, and that the respondent was the occupier of it. The evidence showed that the cars were being broken up on a rail outside the shed, but he was of opinion if the shed was a warehouse, the car on which the applicant was working, could be deemed to be in it, as it was put outside for want of room inside. There was good authority for the view that where there was an overflow of goods from a warehouse, they would be considered, for the purpose of the Compensation Act, to be in the warehouse. As regarded the actual question whether a tram depôt was a warehouse, his Honour took the view that, in the general acceptation of the term, it was no more a warehouse than a coachhouse, or than a motor-car shed belonging to a private individual was a warehouse. It was a shed for the storage of tramcars, and did not contain goods or merchandise for sale. As to whether it was a warehouse within the meaning of the Act, his Honour also took a negative view, though he confessed that the case was one of some difficulty. He dismissed the application, but intimated that if it should be of any value to the workman at any future time, he found that the respondent could be deemed to be the occupier of the place within the meaning of the Factory Act.

Electrical Fittings Co. v. E. J. Bryant.

Before Judge Philbrick, K.C., at Bournemouth County Court on July 17th, the Electrical Fittings Co., 38, Conduit Street, London, W., sued Edwin J. Bryant, electrical engineer, 35a, Old Christchurch Road, Bournemouth, for £53 12s. 11d. due on a bill of exchange in respect of goods supplied.

The defendant counter-claimed for £30 damages for alleged breach of agreement, contending that it was agreed that he should have the sole right of the sale of the plaintiffs' fittings in Bournemouth or neighbourhood. He stated that the same goods were displayed and sold by a local firm of ironmongers, who were one of his keenest competitors, and in consequence he had suffered loss of sale. Defendant also claimed that the period of credit had not expired.

For the defence it was contended that the defendant had only the exclusive sale in Bournemouth proper.

Judgment was given for plaintiffs for £52 5s. 11d., and for the defendant for £1 on the counterclaim.

Libel Action.

In February last a letter appeared in the *Yorkshire Evening Press* from a correspondent named Sharp, in which it was stated that the electric lighting firms in York were the most unbusinesslike and incompetent class of tradesmen in the city, and that they were quite behind the times. As the firms were very few in number, the York Electrical Co., Ltd., and its managing director (Mr. Wainwright) sued Sharp for libel. The case was heard at York on Saturday before a special jury, which found that the words did apply to plaintiffs, but only one farthing damages was awarded, on the ground that they had not suffered, and were not likely to suffer, injury to their business. The Court declined to deprive plaintiffs of their costs.

Johnson v. Manchester Corporation.

At the Manchester County Court on 18th inst., when plaintiff's claim for £14 personal injuries sustained in a tramway accident was mentioned, it was stated that the Corporation wanted a jury to try the case. On behalf of plaintiff a request was made for the case to be transferred to the Salford Court. Judge Parry said he presumed the Corporation wanted a jury of Manchester ratepayers. That he objected to—he was sorry the Corporation thought a jury necessary. The case was accordingly transferred to the Salford Court.

Hawkes v. The Electrical Corporation, Ltd.

On 20th inst. in the King's Bench Division, before the Lord Chief Justice and a special jury, this case commenced its hearing. Plaintiff, Mr. O. C. Hawkes (of O. C. Hawkes, Ltd., manufacturers and electrical engineers, Globe Works, Bromsgrove Street, Birmingham), sought against the Electrical Corporation, Ltd., of Gracechurch Street, London, and J. A. Bauer, a director, the rescinding of contracts dated December 8th, 1904, to take 6,500 shares in the Electrical Corporation, Ltd, rectification of the register of the Corporation by removing the plaintiff's name therefrom, and repayment of sums amounting to £4,000 as against each of the defendants. A full report of the first day's hearing will be found in the *Birmingham Daily Post* for Saturday last.

The plaintiff's case was that the defendant Bauer in 1899 promoted the defendant company, and was a director. On December 2nd, 1904, Bauer orally agreed with the plaintiff that he would assign the defendant company his patents in the Pluto electric heating and cooking apparatus for £5,000 (£4,500 in shares and £500 in cash), and that plaintiff should have the option for 11 days to purchase half of the 13,000 £1 shares standing in Bauer's name on the register of the company for £6,500. This agreement was subsequently reduced to writing, and plaintiff entered into an agreement in writing with Bauer and the company to apply for and accept allotment of 6,500 shares of £1 each in the defendant company. On December 14th the company allotted the shares, and the plaintiff paid £3,250 by cheque on account. On May 25th, 1905, plaintiff paid by cheque to the company another sum of £750. The plaintiff said he was induced to enter into this contract and to pay the sums referred to by false and fraudulent representations made by Bauer on his own behalf and on behalf of the company.

The Defendants admitted that the representations complained of by plaintiff were made, but said that, so far as the representations were matters of opinion, Bauer honestly entertained such opinion, and so far as they were as to matters of fact, it was not admitted that they were in any material respect untrue. As to the claim for rescinding the contract, the defendants said that plaintiff did not repudiate the agreements within a reasonable time; that, on the contrary, after full knowledge of all material facts, plaintiff ratified and confirmed the agreements. The defendants also said it was a term of the agreement that the defendant company should employ O. C. Hawkes, Ltd., of which plaintiff was managing director, to manufacture certain articles, and the taking of shares in the defendant company formed the consideration for this clause. In pursuance of it Hawkes, Ltd., had been employed and had been paid £700 in respect of goods manufactured by them.

Mr. Lush, K.C., Mr. Shearman, K.C., and Mr. Schiller were counsel for plaintiff; Mr. Rufus Isaacs, K.C., Mr. J. B. Matthews and Mr. Engelbad for defendants.

On Monday, Mr. Rufus Isaacs informed the Court that the parties had come to terms. The *Birmingham Daily Mail* learns that the contract has been rescinded, with the payment of £4,000 and costs agreed to.

Dudley, Stourbridge and District Electric Traction Co., Ltd., v. Corporation of Dudley.

This case came before the Court of Appeal, composed of Lords Justice Vaughan-Williams, Romer, and Cozens-Hardy, on the appeal of the plaintiffs from a decision of Mr. Justice Swinfen Eady in the Chancery Division.

Mr. Cripps, K.C. (with him Mr. R. J. Parker) in opening the appellants' case said the matter in dispute was shortly this: An agreement was entered into between the predecessors in title of the present plaintiffs and the Dudley Corporation as to the taking over by the Corporation of railway No. 5 at a certain date, and the question in dispute was as to how the valuation was to be made on the taking over of that railway. The case came before the Court in the form of a special case stated by the arbitrator. The appellants' case was that the Light Railways Act in valuations of this kind gave the vendors the right of having a fair price as between the vendors and purchasers. The case on the other side was that the principle in the Tramways Act applied. The difference between the valuation on the one principle and the other amounted to upwards of £16,000, the valuation on the one principle being twice as much as in the other. The question was which of these principles was right.

As it transpired during the arguments that the Board of Trade's sanction had not been obtained to the appointment of an arbitrator, the case was ordered to stand over for this purpose.

[Other Legal Intelligence will be found in our "Notes" columns.]

Electrical Vehicles.—Herr Muller, a director of the Accumulator Works Co., of Berlin, informed the shareholders at a recent meeting that the storage battery had made progress for traction purposes in the country. It was beyond doubt that the accumulator was intended to play an important part for automobiles in large towns and for distances which were not too far. If the development of that branch was not yet very great it was not the battery but the construction of suitable vehicles which was behind hand. The director further stated that electric motor-cars would in time be brought out by very powerful companies, and in that way the introduction of such cars would assume an extraordinary degree of importance.

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer.]

"Hee" writes:—"We have a case here of a somewhat interesting nature, and I shall be obliged if you can give me some information in regard to it.

"The borough boundary in a certain road runs down the middle of the road, and we have supplied two houses on the side outside the borough, the service line in each case crossing the road and going outside the borough, the part outside being on private property.

"We are now threatened with an injunction, and I propose to build a pit inside the borough boundary and fix a cut-out and meter therein, leaving it to the consumer to affix his wires.

"There is, I believe, a leading case on this point, where electricity is supplied only up to the boundary, but is used beyond it, and I shall be greatly obliged if you can refer me to this leading case and give me any other information in your power on the matter."

*** There is a case relating to the supply of *gas* which is material to the above query, and renders it probable that an application for an injunction would be successful. In Gas Light and Coke Co. *v.* South Metropolitan Gas Co. 62, L.T. 126, a gas company in the metropolis, at the request of a railway company, placed a meter on a part of a railway station lying within the company's limits, and through it supplied gas to other parts of the premises situated outside the company's limits, and within the limits of another company. The Court of Appeal held this to be lawful, on the ground that the sale and delivery of the gas took place at the meter; but the House of Lords reversed this decision, holding that the gas was supplied where it was consumed, and therefore that the company were transgressing their authorised limits. It is anticipated that the courts would apply the principle of this case to electricity, and it should be added that the proposal made in the third paragraph of the query would at once be held to be a more colourable evasion of the law.

"Hee" is recommended not to take any step in the direction proposed without competent legal advice.

"Father O'Flynn" writes:—"In a town where the lighting authority charge a high rate for putting the service cables into a consumer's premises, may the consumer (1) employ a contractor to lay so much of the main as is on, say, his private garden? or (2) may he demand a detailed account, in preference to paying in advance the estimated amount of the cost, which is the usual thing?"

*** It is quite open to any consumer to lay so much of the main as may be on his own premises, and he may certainly employ a contractor to do the work. As to the question whether he may demand a detailed account, this is one which can only be settled by reference to the agreement between the parties.

PARLIAMENTARY.

Electric Lighting Provisional Orders (No. 4) Bill.—This Bill came before Mr. Campion on Thursday last week. The orders related to Aylesbury, Boston, Castle Ward, Weetslade and Cramlington, Godalming (Extension), Gomersal, Henley-on-Thames, Pinner, Stanmore, Harrow Weald, and Edgware, Ryton, Swanage and Wantage and district. The Bill was ordered to proceed.

Electric Lighting Provisional Orders (No. 3) Bill.—This Bill was also before Mr. Campion on Thursday last week, and was ordered to proceed. The orders relate to Bellshill, Blantyre, Bothwell, Dunfermline and district, Dunoon, Fochabers, Inveresk, Shettleston and Tollcross and Uddingston.

London Traffic.—In the House of Commons on 23rd inst. Sir J. Dickson-Poynder asked what steps the Government proposed to take to give effect to the recommendations of the Traffic Commission, in view of the traffic problems of the metropolis having now reached so acute a stage. Sir H. Campbell-Bannerman, in reply, said the Government required more time for considering the recommendations of the Traffic Commission. They had also to bear in mind that the report of the Royal Commission on Motor-cars and the Select Committee on Cabs might have some bearing on the question.

Third Readings.—In the House of Commons on 18th inst., the following were ordered for third reading:—Folkestone, Sandgate and Hythe Tramways Bill; and the Wallasey Tramways and Improvements Bill.

On July 20th, the Lords' amendments to the London United Tramways Bill, and the Twickenham and Teddington Electric Supply Bill, were agreed to, and the West Yorkshire Tramways Bill was read a third time.

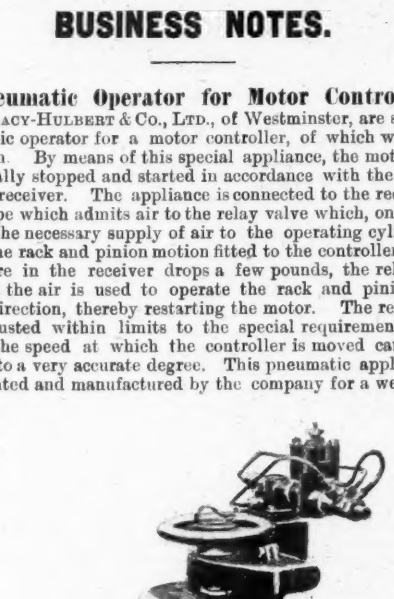
On July 23rd, the Lords' Amendments to the Baker Street and Waterloo Railway Bill were agreed to, and the Newcastle-on-Tyne Electric Supply Bill, and Wallasey Tramways and Improvements Bill passed third reading.

On 23rd inst. the Kent Electric Power Bill was ordered for third reading.

Royal Assent.—The following have received the Royal assent:—North-East London Railway; Wireless Telegraphy; Electric Lighting Provisional Orders (No. 5) and (No. 6); Buenos Ayres Grand National Tramways; North and South Shields Electric Railway; Brixham Gas (electric lighting); Metropolitan District Railway; Nottinghamshire and Derbyshire Electric Tramways; Metropolitan Railway; Cumberland Electricity and Power Gas; Folkestone and District Electricity Supply.

BUSINESS NOTES.

A Pneumatic Operator for Motor Controllers.—Messrs. Lacy-Hulbert & Co., Ltd., of Westminster, are supplying a pneumatic operator for a motor controller, of which we give an illustration. By means of this special appliance, the motor can be automatically stopped and started in accordance with the pressure in the air receiver. The appliance is connected to the receiver by a small pipe which admits air to the relay valve which, on opening, furnishes the necessary supply of air to the operating cylinder for working the rack and pinion motion fitted to the controller. When the pressure in the receiver drops a few pounds, the relay valve closes, and the air is used to operate the rack and pinion in the opposite direction, thereby restarting the motor. The relay valve can be adjusted within limits to the special requirements of the case, and the speed at which the controller is moved can also be regulated to a very accurate degree. This pneumatic appliance has been invented and manufactured by the company for a well-known



Pneumatic Controller.

electrical company, and it is believed that it will prove a very useful automatic means of controlling motors used for driving large air compressors. It is believed that the use of compressed air for working stop valves, regulators and other appliances might be very considerably extended in central stations, as the cost of a small compressor to provide the necessary air is very small.

Annual Outings.—On Saturday, 21st inst., the Poplar Borough Council electricity department held their second annual outing. Officers and workmen numbering 54 mustered at the works in Glaucus Street, and left in brakes for Thornwood Common, Epping, where a most enjoyable day was spent. Dinner was served at the Carpenters' Arms, the chair being taken by Mr. J. Horace Bowden, the borough electrical engineer and manager, who was supported by Councillor H. R. Barge, the chairman of the Electricity Committee. Cricket and other sports were indulged in during the afternoon. For the return journey, the brakes were illuminated by electric fancy lamps.

The employés of Messrs. Engineering Instruments, Ltd., Islington, held their annual outing on Saturday last, July 21st. The party went by train from Liverpool Street station to Rye House, and on arrival they inspected the rooms and dungeons of the historic Rye House, afterwards walking along the banks of the River Lea to St. Margaret's, Herts, where dinner was served at the Crown Hotel. During the afternoon boating and drives were indulged in, the party all meeting again at the Crown Hotel for tea.

Electrical Manufacture in Russia.—The statutes of the United Cable Works Co., to which reference was made in a previous issue, have now been published in the Russian official law journal. The company, which is a joint promotion of the three large groups represented in the electrical branch in Russia, has taken over the cable works of the Russian Felten and Guilleaume Co., and the Russian Siemens & Halske Co. in St. Petersburg. In addition to this the new company is authorised to establish other cable works, to undertake electrical and machine construction, and to carry on electrical installations. As founders are given the names of Herr C. Waihter, of Felten & Guilleaume; Herr H. Gorz, of Siemens & Halske; and Herr E. Schaikewitsch, of the Russian Allgemeine Electricity Co. The share capital amounts to £600,000, of which £480,000 serves partly as the purchase price of the "inbringings," while the remaining £120,000 will be called up later on. The three parent concerns take over in three equal parts the shares representing the sum of £480,000. The Westinghouse Co., which was recently reported to have acquired the undertaking of the Compagnie Centrale d'Electricité, of Moscow, has now obtained an alteration in its statutes, whereby the company is empowered to construct all kinds of electrical machinery, and to carry out all classes of electrical installations in Russia.

An Irish International Exhibition.—Arrangements are in a forward state for this exhibition, which is to be held in Dublin during the summer of next year. The idea of such an exhibition was mooted three years ago as part of a scheme for bettering the commercial and industrial condition of the country. The site selected is served by three lines of tramways, and is in touch with railway and other systems of transportation. Part of the site, presented by the Earl of Pembroke, is to be a public park after the exhibition closes. A number of pavilions are to be arranged for British, foreign and Colonial exhibits of motor-cars, electric lighting, Irish industries, machinery and power houses.

A large building is now being erected for what in the meantime is called the power and machinery section. It is intended to accommodate the machinery and plant for the production of power and lighting for the buildings and grounds. In the transportation section many railway and steamship companies, also the Dublin United Tramways Co., will be exhibiting. The building will also accommodate machinery in motion. As regards electricity, provision has been made for a large display by engineering firms. The progress made is not yet of a substantial character; but in connection with the power and lighting for the purposes of the exhibition itself Messrs. Babcock & Wilcox are putting down the boilers. Messrs. Combe Barbour, of Belfast, are supplying the steam engines. A number of firms like the British Westinghouse Co. and others are sending the dynamos. In addition to these, several of the makers of gas engines, such as Messrs. Crossley Bros., the National Gas Engine Co. and others are putting down gas engines. It is intended that, roughly speaking, one-half of the current for power and lighting will be produced by steam plant, and the other half by gas-driven plant. We are informed that, "if exhibitors of electrical plant are not so far quite alive to the advantages of the exhibition, the same cannot be said of gas contractors." A powerful committee of gas contractors has been formed in London, and it is expected that they will fill a building, to be specially constructed for their occupation, with all varieties of gas appliances for lighting, cooking and heating. The Association of Gas Engineers, who have never hitherto held meetings outside of London, have arranged to hold their meetings next year in Dublin. The knowledge of these facts ought to induce electrical firms seriously to consider the question of exhibiting. A list of the various sections appears in an official pamphlet which has been issued from the offices, Herbert Park, Ballsbridge, Dublin. There is a strong guarantee fund. Mr. James Shanks is the chief executive officer. No effort is being spared to make the exhibition successful in the stimulation of commercial development and the promotion of industrial education.

The Printing Trades Exhibition.—The International Printing, Stationery and Allied Trades Exhibition, which is now in progress at the Royal Agricultural Hall, Islington, is well worth a visit from such of our readers as can, without a great deal of inconvenience, manage to get there before it closes on Tuesday next, 31st inst. The electrical engineer will be gratified to find electric motors in service driving some machine or other in all parts of the building. It is winning its way with remarkable success in the printing trades against the gas engine wherever electricity is obtainable at reasonable prices. At the extensive stand of Mr. E. A. Braddick there will be found some examples of "Caradoc" fine art printing machines, also some Wharfdales, litho and platen machines, driven by British Thomson-Houston electric motors, which are supplied with power from a Lancashire Dynamo Co.'s machine driven by a 22-B.H.P. "National" gas engine which gets its supply from a Dowson gas plant. Motors supplied by Messrs. Electromotors, Ltd., of Manchester, are to be found at work on one or two stands, notably, that of the Lanston Monotype Corporation, Ltd. The Charing Cross, West End, and City Electric Supply Corporation has a stand where many electric fans help to make it "the coolest place in the exhibition," and where some minor electric power applications are shown. Messrs. J. H. Holmes & Co. have the most striking purely electrical exhibit, shown in conjunction with the printing machinery exhibit of Messrs. James Salmon & Son. The Lundell motor printing press equipments, also the Holmes-Clatworthy electrical equipment for driving rotary printing presses with push-button control, are shown. At the great central stand occupied by Linotype and Machinery, Ltd., can be seen a number of Linotype composing machines, driven by L. & M. special electric motor outfits, also Miehle two-revolution presses, rotary presses, and a guillotine cutting machine, all equipped with "L. & M. electric motors," which have been specially designed for the requirements of the printing trade. Each motor is connected to the press by belt, which is the method best suited to presses of this description. Each motor is fitted with a tramway-type controller and compound resistance, the controller being capable of running the presses at eight different speeds; the first four regulate speed by armature control, the fifth position is the normal speed, and the sixth, seventh and eight regulate by shunt resistance. The range of speed is 35 per cent. down to 25 per cent. up. All the live parts are effectively protected, and danger from fire is reduced to a minimum. Mr. A. Wantzen at his stand has an electric motor overhead, driving a shaft operating bag-making, two-colour reel-printing and envelope machines. Messrs. Crossley Bros. exhibit a suction gas plant with combined gas engine and dynamo. Messrs. Hunter, Ltd., show a patent arc gear process camera. Messrs. A. W. Penrose & Co., Ltd., have an exhibit of their enclosed arc lamps, motor-driven Royal routers and jig saws, also a motor air pump for aerograph work. Messrs. F. A. Glover & Co., Ltd., exhibit copper and nickel depositing vats, an electric motor driving an electro-depositing dynamo, and various motors for printing machinery. Other features noted on the occasion of our visit were a motor-driven Stringer composing and type-casting machine, and an exhibit of Messrs. Tangye's gas engines, dynamos, motor-driven treble ram pumps and suction gas plant. In the gallery can be seen a useful device for electrically recording in the managers' office the output of, and time operated by, machinery in the printing works. The recorders shown are indicating during the run of the exhibition the work performed by certain machines to which they are connected down in the main hall. They are supplied by the Machinery Output and Time-Recorder, Ltd., of Manchester, and obviously have manifold applications. Apart from the purely electrical exhibits there is much of an extremely interesting character to be seen from a general standpoint. Book-binding, paper-making, type-casting and setting and many other processes are being carried out, and half-tone block work, three-colour printing, picture postcard displays, all combine to enable the visitor to spend some hours in a very profitable manner.

The Brush Company at Work.—For some months past the Brush Works have been going at extra high pressure, nearly every shop working largely on overtime, and recently it has been found necessary to employ a double shift throughout almost the entire factory. Current orders are of such importance that there is no early prospect of any relaxation, and the only apparent means of obtaining permanent relief seems to lie in considerable extensions of the workshops. In the heavy shop there are now being manufactured a large number of turbo-alternators, including one of 1,500 KW., four of 1,000 KW., and three of 500 KW., together with direct current turbo sets ranging from 250 KW. to 750 KW. Reciprocating engines of 500 KW. are passing through the works for Grimsby, Bermondsey and Leyton, and in the two former cases the engines are being coupled to Brush dynamos. Of smaller reciprocating sets, ranging from 80 KW. to 250 KW., there are a large number. There is noticeable in this shop a big condenser of 6,000 sq. ft., which is a repeat order. In the motor department, where work is also being carried on night and day, direct current and three-phase motors are being rapidly turned out. Perhaps the most interesting contracts being executed are a large series of three-phase textile motors for the Fine Cotton Spinners' Association, and a round dozen of direct current printing motors for Messrs. W. H. Smith & Son, which represent a repeat order. Other motors in hand are for collieries, cranes and other applications. On the rolling stock side, developments are to be observed which would probably surprise those who have not lately visited the Brush Works. Here are to be seen a number of first-class main line railway coaches of the most luxurious description for the Cheshire Lines Committee, other corridor carriages, also first-class, for the Great Central Railway, and several types of rail motor-coaches for the Dublin and Wicklow and Great Northern of Ireland Railways. The company has also a large order in hand for dining and other coaches for the Soudan Railway. It will be seen, therefore, that the Brush management has made a spirited re-entry into high-class railway carriage work, which department was somewhat neglected during the period of heavy demand for tramcars. There are, however, tramcar and truck orders being executed for Falkirk, Keighley, Mexborough, Pontypridd, Plymouth, Rochdale, Sheffield, Torquay and Yarmouth, and foreign orders for Bombay, Shanghai, Rangoon, Auckland (N.Z.), Carthagena and Malta. Considerable business is being done in motor-'bus bodies, chiefly for London service, and the company is now undertaking in spacious new shops the manufacture of motor-omnibuses. Another very large and lofty new shop, 310 ft. long and 150 ft. wide has just been erected with expensive equipment, which includes hydraulic and pneumatic plant, for the manufacture of steel rolling stock for passengers, goods and minerals. The company has some big orders for all-steel wagons of 20 and 40 tons capacity, and is also building steel coaches for the City and South London Railway. Altogether the present condition of the Brush works is such as to afford the greatest satisfaction, not only to the directors and shareholders, but to the very numerous professional friends of the company who have, at one time or another, been connected with its operations. The rapidly growing success of the Brush is as good a reply as could be found to the foolish allegations in the daily Press as to the comparative want of enterprise and ingenuity on the part of British manufacturers.

Bankruptcy Proceedings.—A. C. M. Jenkins.—Under the failure of Alexander Cadogan Morris Jenkins, described as a general merchant, of 140, Leadenhall Street, E.C., the first meeting of creditors was held last Wednesday at the London Bankruptcy Court before Mr. G. W. Chapman, Official Receiver. The statement of affairs was not lodged, but the debtor roughly estimates his liabilities at £9,000, and has no available assets. He states that his position is due to the failure of the Otto Electrical Manufacturing Co. (1905), Ltd. In May, 1905, he obtained an option to take over that concern at the agreed price of £10,000 cash and £15,000 shares. He paid a deposit of £500, and provided the money necessary for the promotion expenses, which amounted to about £5,000 out of a loan of £10,000, obtained from a friend. As vendor of the proposed company he was to have £20,000 cash and the balance in shares, the capital of the company being agreed at £75,000. He agreed to pay out of the £20,000 cash consideration the £10,000 to the old company, and he further undertook to find £20,000 for working capital. The new company never went to allotment, because the public only subscribed about £1,200, and the minimum required before proceeding to allotment was £20,000. He accordingly lost the whole of the money he had invested in the company, and was, in addition, held liable for debts of the company to the amount of about £300. The Otto Electrical Manufacturing Co. (1905), Ltd., went into liquidation, Mr. Fletcher, of George Street, Mansion House, E.C., being appointed to the post of liquidator. Mr. G. T. B. S. Thurnell attended the meeting on behalf of the debtor, and no offer being submitted, the case was left in the hands of the Official Receiver to be wound up in bankruptcy.

T. H. Hunter.—At Sunderland Bankruptcy Court on July 19th, Thomas Hudson Hunter, electrical engineer, of West Hartlepool, was examined. Debtor produced accounts which showed that during the last three years he had lost over £200 on his business. The examination was adjourned for a month.

Catalogues and Lists.—The Cambridge Scientific Instrument Co., Ltd. New catalogue (No 39) of 70 odd pages, entitled "Technical Thermometry."—The first part is devoted to showing the many applications of electrical thermometers; the electric resistance thermometers, thermo-electric thermometers, and the Fery radiation pyrometer, being described and explained in full detail. There are altogether three sections in the catalogue (I) dealing with the more particular commercial applications of pyrometers; (II) dealing with scientific or research work; and (III) an appendix explaining the theoretical considerations of the instruments and giving tables of general interest. Attention may be specially called to the table of melting points provided by Dr. Harker, of the National Physical Laboratory. It will be found that these values differ very materially from those generally accepted in text books. A description is given of the thread recorder, an instrument which is believed to have a large future before it, and records are reproduced which have been obtained with it, one being a record of the temperature of a biscuit kiln in a large pottery works in the English Midlands with a Fery radiation pyrometer and a patent thread recorder. The method of mounting the Fery radiation pyrometer for recording continuously the temperature of a kiln is illustrated. A closed fireclay tube is inserted in the walls of the kiln and the pyrometer is mounted on an iron bracket outside the kiln and is focused on the closed end of the tube. This end will be practically at the temperature of the adjacent saggers or bricks, and cold air is prevented from entering the kiln and thus chilling the work. Reproductions are given in the list of records obtained from pyrometers inserted in annealing furnaces, gas retorts, &c. An interesting application of the company's electrical thermometers is that of measuring the temperature in cold stores. In the past the tedious method of sending a man round to read a mercury thermometer fixed in every chamber was adopted, but now it is possible by means of electrical thermometers for the engineer to read the temperatures throughout a large building from the engine room. In the case of one large cold store the time saved in reading the thermometers by the company's method amounts, we are informed, to no less than six hours a day. In the majority of cases, therefore, the installation may be expected to pay for itself in less than twelve months. Among other interesting matters outlined in this very serviceable list is a bonus scheme for avoiding damage to goods undergoing treatment, keeping down fuel consumption and convincing the the workman that the recorder is a help to him. The firm holds that the way to make an instrument a success in works is to impress on the workman the fact that the instrument is installed as a help to him rather than as a policeman to keep a record of his shortcomings.

Messrs. Veritys, Ltd.—New 4-pp list (No. 536), giving illustrated particulars and prices of the improved type "Aston" motor-starters, also of cast-iron covers for the same. A good many general data, also approximate dimensions, are set out in tabulated form. This apparatus has now been on the market for some six years with increasing sales. In the compilation of the list a point has been made of giving the total resistance in ohms, the current on the first stop, particulars of the shunt current, &c.

Messrs. W. H. Bailey & Co., Ltd., Salford.—Illustrated pamphlet (28 pp.), giving full information concerning their "Aqua-Thruster" steam pump.

Societe Francaise d'Electricite A.E.G., Paris.—Price list of electro-magnetic volt and ampere meters.

The General Electric Co., Ltd., London, E.C.—July "Progress" sheet, detailing prices of Union steel conduit fittings, safety tumbler switches, and cut-out boards, and announcing reductions in prices of the "Adaptor" fan, measuring instruments, and electric mining and outdoor bells.

British Westinghouse Electric and Manufacturing Co., Ltd.—Two useful and interesting brochures containing full descriptions and numerous half-tone views, with maps, of (1) the Clyde Valley electric power supply undertaking; and (2) the Metropolitan Railway. In the latter pamphlet there is a brief account of some of the difficulties that presented themselves in connection with the transformation of an old steam line into a modern electric one. Some historical notes concerning the original system are followed by an account of the Neasden power station and its plant, also some particulars and views of the new rolling stock and the system of electrical operation and control.

Messrs. Kelvin & James White, Ltd., Victoria Street, S.W.—New pamphlet describing the latest type of Kelvin multicellular electrostatic voltmeter, in which a much longer scale than in the older type of instrument has been obtained without the size being increased to any great extent. The pointer has been fitted on edge, and a mirror has been fitted below the pointer, so that accurate readings can be obtained, and any error due to parallax annulled. In the older pattern instrument of this type, the case was connected to one of the terminals, and consequently was alive, but in the newer form the movement and cells are entirely insulated from the case, so that the latter can be earthed. We understand that in recent instruments of this type sent to the Board of Trade laboratory for a certificate an accuracy of one-tenth of 1 per cent. has been obtained. The list is well illustrated, and prices and code words are given.

The Power Plant Co., Ltd., London, E.C.—Two cards, for filing on "Index" system, relating to their Globoid roller worm gear as supplied for various electricity works, and their machine-cut double helical gears with metal pinions.

Mr. Edward Brand, 35, Shakespeare Street, Manchester.—Illustrated price list of wall and ceiling dowels with screw-on insulating knobs. A card of specimens of these useful articles has also been received.

Messrs. Nalder Bros. & Thompson, Ltd., London, E.C.—Several new lists have just been published by this firm. One contains a description of the N.C.S. combined ohmmeter and generator; a second gives a list of new reduced prices for Crawley's patent automatic accumulator switch; and a third sets out code words and new and reduced prices of different types of ammeters and voltmeters, round pattern moving-coil instruments and gravity gauges.

Trade Announcements. — The business formerly carried on by Robert Hanke's successor, at Ladowitz, Bohemia, has been converted into a private limited company under the style of G. Bihl & Co. vormals Robert Hanke's Nachfolger G.m.b.H. The electrical department has been enlarged by the addition of two new kilns, which will materially assist in the matter of deliveries. The change of style will involve no change whatever in the management or carrying on of the business, and the British representation is still in the hands of Mr. Archibald Campbell, of 27, Chancery Lane, E.C.

The Union Electric Co., Ltd., announce that their address is now Park Street, Southwark, S.E.

Messrs. J. G. White & Co., Ltd., notify that their registered address, and the public entrance to the offices, will be 9, Cloak Lane, Cannon Street, E.C.

Mr. A. Goldie Engholm, A.M.I.M.E., A.M.I.E.E., 30, Church Street, Birmingham, has taken over the entire steam department of Messrs. Robert W. Blackwell & Co., Ltd., for the sale of wrought-iron pipes, fittings, valves and pumps. He has also been appointed sole agent for the Midlands for Messrs. Blackwell for the sale of their electric tramway supplies, circuit breakers, P. and B. and other insulating materials; for Messrs. Hayward-Tyler & Co., Ltd., hydraulic engineers and pump-makers; Buffalo Forge Co., of London, for the sale of their special heating and ventilating plants, smiths' forges, blowers and fans; and for the Trussed Concrete Steel Co.

Messrs. J. B. Saunders & Co., of 1, Palmer Street, Westminster, have removed to larger premises adjoining, and their offices are now in the White Mansion, 91, York Street, Westminster.

The Pulsometer Engineering Co., Ltd., have recently opened offices in Manchester, at 206, Corn Exchange Buildings, Cathedral Street, with Mr. George Thompson as manager. The company's agency with Messrs. F. B. Welch & Co. is, therefore, terminated.

The head offices of the Lancashire United Tramways, Ltd., South Lancashire Tramways Co., and the Lancashire Light Railways Co., Ltd., have been removed to Atherton, Lancs. The new telegraphic address is "Tramways, Atherton," and the telephone number, "36 Atherton."

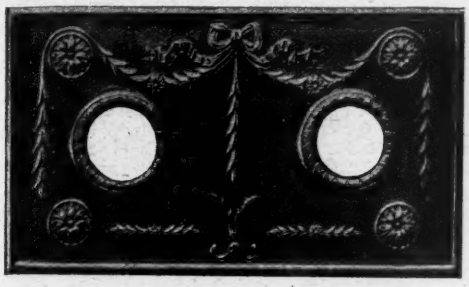
Electric Welding of Rail Joints.—It is stated that in Germany a large electric arc is being used for welding rail joints, the positive electrode consisting of a carbon rod, and the negative of the rails themselves, supplied with current by a special generator. The joint is held in a mould, and sufficient metal, of the same composition as the rails, is melted round the joint to ensure the mechanical strength of the latter.

For Sale.—Under the liquidation of the Goodfellow Engineering Co., Ltd., a stock of motors and dynamos, and a gas engine and generator set, are now offered for sale. See our advertisement pages to-day.

France.—The balance-sheet of La Compagnie Continentale Edison for the last financial year shows a profit of £42,388.

War Office.—The War Office has placed a contract with Siemens Electric Appliances, Ltd., of Westminster, for an electrical fire alarm installation at the Royal Gunpowder Factory, Waltham Abbey.

Art Metal Covers for Switches. — We recently inspected a variety of ornamental covers for sunk switches, &c., produced electrolytically by the LONDON DECORATIVE METAL WORKS, LTD., of 44 and 46, Eagle Street, W.C., and we reproduce herewith a few of the designs, many of which were of high artistic merit. The plates are made in various styles, and are highly finished, the execution being equal to that of castings costing many



SWITCH-PLATE IN THE ADAM STYLE.

MODERN FIGURE SUBJECT.

BELL-PUSH COVER.

times as much to produce, while, being of solid copper, with a considerable mass of that metal in them, they are mechanically strong enough for any requirements. The process is used to produce also finger-plates and other decorative metal work. The manufacture is conducted under the supervision of Mr. F. S. Spiers and Mr. H. Sayer.

Dissolutions and Liquidations.—THE LIQUID (ELECTRIC) REGISTER SYNDICATE, LTD.—This company is winding up voluntarily with Mr. D. S. Fripp, 14, Finsbury Circus, E.C., as liquidator.

HONG KONG TRAMWAY ELECTRIC CO., LTD.—This company is winding up voluntarily with Mr. G. G. Walker, 19, St. Swithin's Lane, E.C., as liquidator. Creditors should send particulars of their debts to Mr. Walker by September 1st.

THE OLDSMOBILE CO. OF GREAT BRITAIN. — Creditors should send particulars of their debts, &c., to Mr. J. Carroll, 51, Darenth Road, Stamford Hill, N., the liquidator, by August 8th.

TAUNTON AND WEST SOMERSET ELECTRIC RAILWAYS AND TRAMWAYS CO., LTD.—A meeting is to be held at Donington House, W.C., on August 31st, to hear an account of the winding up from the liquidator (Mr. P. N. Gray).

MESSRS. READ & GALE, electrical engineers, 10 and 11, Cursitor Street, London.—Messrs. F. W. Read & F. H. Gale have dissolved partnership. Mr. Gale will attend to debts and continue the business as the Electrical Installation, Maintenance and Construction Co.

KNIGHT BROS., cycle and electrical engineers, Brighton.—Messrs. H. Knight and E. C. Sparks have dissolved partnership. Mr. Sparks attends to debts.

HANWAY ART METAL WORKS, Hanway Place, London, W.—Messrs. H. C. Peirson, H. C. Petitjean and R. F. Curtis, have dissolved partnership as art metal manufacturers and electrical engineers. Messrs. Petitjean and Curtis will attend to debts, and continue the business under the old style.

Book Notices.—*Lexikon der Elektrizität und Elektrotechnik.* Edited by Fritz Hoppe. Published in 20 fortnightly parts, price 6d. each. Vienna: A. Hartleben.—This German dictionary of electrical terms is one of a series of technical dictionaries published by Messrs. Hartleben. It aims at giving concise modern definitions aided by illustrations, and is based on a thorough study of the technical Press, and of the catalogues of the representative German manufacturers. Judging from Part 1, which contains 48 pages, and reaches to the word "Aperiodisch," the treatment is accurate, and, usually, concise, although some definitions are extended to a quite unwarrantable degree. The word "akkumulatoren," for instance, is dealt with at large in over 11 pages, which read more like a treatise on the subject than a dictionary definition. Cross references are largely used, but references to text-books or other technical literature do not occur, and this is a decided advantage in a work of this nature.

The Technolexicon of the Society of German Engineers.—About 2,000 firms and individual collaborators at home and abroad are assisting in the compilation of this universal technical dictionary for translation purposes (in English, German and French) that was commenced in 1901. Over 3,000,000 word-cards have been collected. Alphabetising has so far advanced that printing will begin early in 1907. The work will be printed and published by the well-known firm of J. J. Weber, Illustrierte Zeitung, in Leipzig. Communications may be addressed to the editor-in-chief, Dr. Hubert Jansen, Technolexicon, Berlin (NW. 7), Dorotheenstrasse 49.

"Journal of the Western Society of Engineers," Vol. XI, No. 3, June, 1906. Chicago: The Society. 50 cents.

"Journal of the Franklin Institute," Vol. CLXII, No. 1, July, 1906. Philadelphia: The Institute. 50 cents.

"The American Institute of Architects' Quarterly Bulletin," Vol. VII, No. 1, April, 1906. Washington: The Institute.

"Lichtstrahlung und Beleuchtung." By Paul Högner. Part 8 of "Elektrotechnik in Einzel-Darstellungen." Edited by Dr. G. Benischke. Brunswick: F. Vieweg & Son. M 3.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXV, No. 6, June, 1906. New York: The Institute.

"Construction des Induits à Courant Continu: Partie Mécanique." By E. J. Brunswick and M. Aliamet. Paris: Gauthier-Villars. 2.50 fr.

"Regulations for Technical Schools, Schools of Art, and Other Schools and Classes (Day and Evening) for Further Education." (From August 1st, 1906, to July 31st, 1907.) London: Wyman and Sons, Ltd. 2d.

"Heads of Statement for the Preliminary Application for Treatment under Section 34 of the Regulations for Technical Schools, &c. 1906-7." Board of Education, South Kensington, S.W.

Big Ben.—We understand that the Bastian mercury vapour lamp is now being used for the illumination of the Big Ben clock dials at St. Stephens.

Holidays.—The LANGDON-DAVIES MOTOR CO., LTD., announce that their works and offices will be closed from Monday, August 6th, to Saturday, August 11th, for the annual holiday. Urgent matters will, of course, be dealt with.

LIGHTING and POWER NOTES.

Bedford.—The T.C. has decided to supply energy to Messrs. W. H. Allen, Son & Co. for power at 1d. per unit net for three years on a minimum annual consumption of 320,000 units. The necessary extensions of mains, &c., will entail a capital expenditure of £2,340.

Bury (Lancs.).—The T.C. has applied for a loan of £17,500 for the extension of the electricity plant and mains, and the provision of offices and show rooms.

Brighton.—A member of the T.C. has given notice to move the rescission of the recent decision to open electric light showrooms in the borough.

Continental Notes.—ITALY.—The authorities of the Province of Chieto have granted a concession for a water-power plant to be put down on the River Sangro for generating electrical energy for the operation of the Adriatico-Sangriti Railway and for lighting purposes. It is reported that about 4,500 H.P. will be available.

RUSSIA.—The Augsburg Maschinenfabrik, Germany, has built four 500-H.P. Diesel engines for the electric lighting station at Kiev. Each set comprises four cylinders, 450 mm. diameter by 650 mm. stroke, the normal speed being 160 revolutions per minute. The engines are adapted to run on crude naphtha as fuel.

SPAIN.—A company has been formed at Madrid entitled "Hidro-Eléctrica del Tonceda," to establish a generating station to supply Ribadeo, Villalba, and other localities with electric power. Supply will also be made to a projected tramway between the above localities and the town of Lugo.

East Ham.—A cable is to be laid to the Isolation Hospital at an estimated cost of £886.

Canada.—OTTAWA.—Our Toronto correspondent says that the civic authority has approached the recently constituted Hydro-Electric Commission requesting assistance under the terms of the Power Bill of last session in securing a cheap supply of electrical energy for the capital. It appears that some time ago the city purchased a distributing plant from the Consumers' Electric Co., of Ottawa, and then entered into a contract with the Ottawa and Hull Power Co., to supply the city with the necessary power. The Ottawa Electric Co., which is now in opposition, brought an action against the city for procuring energy not in accordance with the Act. The Act allows municipalities to develop power, or to distribute it, but makes no provision for purchase from any other undertaking. The Hydro-Electric Commission, however, can either lease power, develop it, or expropriate from another company. The Court gave judgment against the city, and now the municipality is asking the Commission to supply the energy. The Government Commissioners have requested the Town Council to pass a resolution making formal application, when it will receive every consideration. It is expected that the Commission will lease the power from the Ottawa and Hull Power Co., and then re-lease it to the city.

HAILEYBURY.—The Ontario Government has granted a charter to the town for the development of a power plant at Hound Chute on the Montreal River. The fall is sufficient to generate 3,000 H.P. For each H.P. developed, the province will receive 50 cents from the holders of the charter, and will at the same time retain all the powers vested in it in regard to the distribution of electrical energy, and will also control the price at which energy is sold to the consumer. Now that Haileybury has secured the charter, a town vote will be taken on the question of installing the necessary machinery and works.

Coventry.—The question of gas *versus* electricity for street lighting was under discussion by the City Council recently, when the Watch Committee recommended that the offer of the E.L. department to supply additional lamps at the present annual rental of £800 be accepted. Alderman Webb Fowler, who proposed the adoption of the recommendation, said a deputation had visited Leicester and had inspected the system of street lighting there, and said that in comparison their own system was far preferable. In the course of the discussion, reference was made to the remarks of Sir William Preece as to gas being considered, by him, preferable for the purpose of street lighting, but Alderman West, the chairman of the E.L. Committee, urged that Sir William Preece had been chiefly concerned with telegraphs, and said that he believed he had very little experience of street lighting, therefore he did not regard him as an expert on this matter. On a division the Committee's recommendation was adopted.

Edinburgh.—With regard to the realised balance of £16,361 on the year's working of the E.L. undertaking, the amount required to bring the reserve fund up to its maximum was £14,927, and the E.L. Committee proposed that that sum be placed to reserve. A counter motion to the effect that £10,000 be placed to reserve and £5,000 to the reduction of the capital debt, leaving £1,361 to the Council for disposal, has been carried by seven votes to three.

Edmonton.—The U.D.C. has affixed its seal to the deed of transfer of the Council's E.L. Order to the North Metropolitan Electric Power Supply Co. In consideration of the transfer the company has paid the Council the sum of £2,800, being the costs of obtaining the order, and expenses subsequently incurred in connection with it. Seven streets are mentioned, in which distributing mains are to be laid down for general supply. The charges for the supply of energy for public lighting are not to exceed, until otherwise agreed, the following rates:—For lighting at least 26 arc lamps on the route of mains to be laid for a period of not less than 15 years, £20 per annum for each 500-watt arc lamp for all-night lighting, and £14 for half-night lighting, and £16 per annum for each 350-watt arc lamp for all-night lighting and £11 for half-night lighting, these amounts to cover the provision, erection and maintenance by the company of the necessary lamps, pillars, &c. For special lighting of these lamps an extra payment at the rate of 1d. per hour for each 500-w. lamp, and ¾d. per hour for each 350-w. lamp is to be made. On December 31st, 1930, the Council may, upon giving six months' notice, require the company to sell the undertaking, and in that event the Council will repay the £2,800 received from the company, and will also pay a sum equal to the amount of capital expended by the company, plus one-tenth of that amount.

Epsom.—The U.D.C. has decided to extend the plant at the electricity works, at an estimated cost of £3,650.

Hanley.—The T.C. has offered to supply energy to the North Staffs. Railway Co. for working the capstans in the goods yards on a minimum payment of £200 a year, with alternating current at 1d. per unit, or continuous current at 1½d. per unit; no supply to be taken between sunset and six p.m. on Monday, Tuesday, Wednesday and Friday in the winter, when artificial light is required before six p.m.

Hastings.—On Monday a L.G.B. inquiry was held into the application of the T.C. for a loan of £8,761 for electricity purposes. A councillor opposed on the ground that the proposed alterations and additions to the plant should have been deferred until the existing deficiency on the current account had been removed. The inspector said that it appeared that the T.C. aimed at nothing less than an insurance for the supply of light, and desired to dispense with plant which was taking up room and earning no revenue.

Farnworth.—Another electrically driven spinning mill, belonging to the Kearsley Spinning Co., is about to be started at Stoneclough.

India.—An estimate amounting to Rs. 17,575 has been sanctioned for providing an overhead electric transmission line and a punkah-pulling machine for the new central offices of the North-Western Railway at Lahore.

The North-Western Railway authorities propose providing electric lights and fans in the Lahore-Karachi mail trains.—*Indian Engineering.*

London.—CITY.—The city engineer in his annual report stated that during the year 599 additional incandescent gas burners had been fixed, making 2,839 in all. By way of experiment, high pressure incandescent gas lamps had been substituted for the electric arc lamps in Lower Thames Street, Monument Street, Queen Street and Queen Victoria Street, while double-burner low-pressure gas lamps had been placed in Fleet Street. There were 110 of these lamps in all, with burners of different sizes. The experiment was still proceeding. The number of electric lamps in use was 465.

BERMONDSEY.—Application is to be made to the B. of T. for a prov. order authorising the B.C. to supply electricity for public and private purposes within the parishes of St. Olave and St. Thomas and St. John, Horsleydown.

HAMMERSMITH.—A temporary sub-station is to be erected in Scrubbs Lane at an estimated cost of £211. No mechanical stoker on the market being suitable, a mechanical stoker is to be built in the Council's workshops, and fitted to one of the smaller boilers, at a cost of £150.

L.C.C.—It was decided at Tuesday's meeting to lend £2,000 to the Bermondsey Borough Council for extension of mains, £45,600 to the Marylebone B.C. for E.L. works, and £23,555 to the Shoreditch B.C. for the purchase of property and machinery.

ST. PANCRAS.—An additional feeder in connection with the supply to the Camden Road and Square district is to be laid at an estimated cost of £2,067. Application is to be made to the L.C.C. for a loan of £10,028 for E.L. purposes. A return has been prepared showing the amount paid for gas for public lighting during the past 12 years, also the amounts paid for electrical energy since the commencement of the supply. For the 12 months ended Lady Day, 1895, £8,839 was paid for gas, the average number of lamps being 4,312, and the price being 2s. 2d. and 2s. 3d. per 1,000 cb. ft. During the same period £4,426 was paid for electricity at 6d. and 5d. per unit, energy being supplied to 96 lamps. For the year ended Lady Day, 1906, the amount paid for gas was £3,734, the number of lamps being 2,024, and the price 2s. 2d. per 1,000 cb. ft. During the same period the amount paid for electricity was £13,376, the number of lamps being 831, and the price being 1½d. per unit. In 1895, £3,402 was paid for lamplighters' and fitters' wages. In 1906 the amount paid under this head was £2,570, notwithstanding an increase in wages.

SHOREDITCH.—The abstract of accounts of the B.C. electricity undertaking for the year ended March 31st last shows a reduction on expenditure (excluding loan charges) from £28,229 in the previous year to £24,753, equal to ·28d. per unit. Notwithstanding, however, this substantial reduction in cost, the net profit, after paying interest and providing for redemption of debt, has dropped to £705, owing to the reduction in the prices for energy, also to the alteration in the system of calculating the maximum demand quarterly instead of half-yearly. The sale of energy for lighting, power and heat (excluding public lighting) increased from 2,533,544 units in 1904-5 to 2,753,461 in 1905-6, the total average price obtained being 2·55d. per unit. The surplus on the year's working is carried to appropriation account to meet the yearly instalment of cost of change of pressure, the result on that account being that there is an adverse balance of £922 to carry forward to next account.

THE METROPOLITAN AREA.—The L.C.C. has sent a circular letter to the borough councils referring to the question of the inconvenience caused by the breaking-up of the streets in the Metropolis by electric companies and others having statutory rights to do so, and to the report issued by the Royal Commission on the subject. The communication goes on to inquire whether in the event of the L.C.C. agreeing to promote legislation to enable it to make regulations to govern the breaking up of streets, the borough councils would be prepared to support the Spring Gardens authority in its application.

THE STRAND.—One morning last week an explosion occurred in the Strand, and the stone cover of a manhole was lifted from its position. The cause was attributed to a short on the underground electric mains.

WESTMINSTER.—The Works Committee of the City Council reported this week having reconsidered its report recommending the acceptance of the tender of the Gas Light and Coke Co. for lighting and maintaining the high pressure lamps in Whitehall and Parliament Street, not included in any other contract. The Committee, after full inquiry, had come to the conclusion that it was advisable that the Council should accept the cheaper tender of the Westminster Electric Supply Corporation for providing, erecting, lighting and maintaining for five years about 17 flame arc lamps, columns, &c. (in place of the existing high pressure gas lamps) at an average price per lamp per annum of £14 16s. 10d. Each arc lamp will be about 1,200 C.P.

Selby.—The U.D.C. has decided to proceed at once with its application for a prov. order for E.L. A scheme is to be prepared by Messrs. Medhurst, Page & Lloyd, and consent is to be withheld from the application of the Electrical Distribution Co., of Yorkshire, for an E.L. order.

Huddersfield.—In order to develop the power load, a sub-committee has decided that for the first 100 hours' use of a motor per half-year at full load, energy shall be charged for at the rate of 2d. per unit, and beyond at 1d. per unit, provided that for each H.P. installed in motors the consumption is guaranteed at 2,000 units a year. If more than 2,000 units per year are consumed and the above guarantee is given, the charge is to be 1d. per unit, subject to certain discounts. A special discount of 15 per cent. is to be given in cases where the account exceeds £15 a year, on condition that motors are not used between four and eight p.m. during the winter months—October and February inclusive—the Corporation also having the option of stopping supply in the event of the plant being overloaded due to fog, storm or accident.

Madagascar.—In his report on the trade of the island for the year 1905, Mr. Consul Porter states that a concession granting a monopoly for the supply of water and electric light to Antananarivo for a term of 50 years was granted in August last by the Government of Madagascar to a French company (La Société Civil d'Etudes de Concessions et Travaux, of Paris) under the terms of which 20 per cent. of the material employed may be of foreign manufacture. By a further agreement the local administration promised to grant to the same company a concession for an electric tramway in Antananarivo, subject to approval by the Colonial authorities of plans to be furnished.

Provisional Orders.—Application is to be made for E.L. powers for the following districts as under, and the local authorities have been notified by the applicants:—

Adlington.—Messrs. A. C. Tupp & W. A. Mitchell.
Buckhurst Hill.—Mutual Electricity Supply Co.
Chorley.—Messrs. Tahourdins & Hitchcock, Parliamentary agents.
Cirencester.—The local Electric Supply Co.
Crompton.—Mutual Electricity Supply Co.
Dalkey.—Irish Electric Lighting Agency.
Egremont.—Messrs. Foote & Milne.
Launceston.—Messrs. Foote & Milne.
Selby.—Electrical Distribution Co., of Yorkshire.
Skipton.—Electrical Distribution Co., of Yorkshire.

Rawmarsh.—The U.D.C. proposes, with the consent of the B. of T., to transfer its E.L. order to the Mexborough and Swinton Tramways Co. The Council is to have the option of purchasing the undertaking at the end of 21, 28 or 35 years, or at any time within 42 years of the date of the transfer as a going concern, at a price to be fixed by arbitration, or after 42 years on the terms of Sec. 2 of the Electric Lighting Act, 1888.

Rawtenstall.—The T.C. on July 20th resolved to generate its own electricity, and all previous minutes relating to the matter of electricity are to be rescinded. Some time ago an agreement was arrived at with the Lancashire Electric Power Co., but it was never signed.

South Africa.—East London.—Mr. Lambe, the town electrical engineer, recently left for Durban on an official tour to report on the electric lighting and tramways systems of Durban, Johannesburg, Kimberley and Cape Town, in view of the proposed reconstruction of the system of East London.

Natal.—The *Board of Trade Journal* states that the *Government Gazette* of June 12th publishes a Bill which it is proposed to introduce into the Legislative Assembly, to increase the borrowing powers of the Borough of Pietermaritzburg, for the purpose of enabling the T.C. to defray the cost of extending, among other works, its electric supply and tramways systems. The schedule includes the following items, viz., electric supply, £23,198; tramways, £45,360.

The Rand.—The *Daily Telegraph* correspondent at Johannesburg says that considerable opposition is being shown with regard to the Victoria Falls electric power scheme, especially by the coal interests. It seems probable that the Bill will be withdrawn pending the granting of responsible government.

West Bromwich.—An unopposed L.G.B. inquiry was held on July 18th into the application of the T.C. for a loan of £5,150 for the provision of additional plant at the Black Lane generating station. It is proposed to install a 400-kw. generator and boiler, which will be necessary during the coming winter.

West Ham.—The accounts of the E.L. undertaking for the year ended March 31st last show that the expenditure during the 12 months on capital account amounted to £19,082, bringing the total on the undertaking to £337,355. The total revenue amounted to £51,371, an increase of £7,308 on the previous 12 months. The increase was mainly attributable to more energy being required for traction purposes. The increase under this head was £5,260; there was an increase of £1,484 for power supply, and £882 for additional arc lighting for the streets. A decrease in the receipts from private lighting of £657 was attributed mainly to the alteration in the price. The total working expenses amounted to £27,471, as against £23,808 last year. The gross profit was £23,900, an increase on the previous year of £3,646; after setting aside for financial charges, there remained a balance of £2,523, and this is to be transferred to the reserve fund, which will then amount to £4,352.

In consequence of information obtained by the borough treasurer and the electrical engineer with regard to the loans of the electricity undertaking since the adjourned L.G.B. inquiry, a new application is to be made to the Board to sanction the borrowing of £58,017 for new expenditure, and £17,634 for excess expenditure. The total new expenditure is made up as follows:—Generation, £17,505; Silvertown extension, £17,212; distribution, £23,300.

Wolverhampton.—An abstract of the accounts of the Corporation Electricity Department for the past year's working has been issued, and in brief the results are as follows:—

Year ended March 31st	1906	1905
Total revenue	£24,572	£22,763
,, working costs	11,327	9,779
Gross profit	13,245	12,984
Interest received	165	116
Interest	4,143	9,646
Sinking fund	6,052	
Net profit	3,215	3,454
Capital expended	172,241	163,876
No. of 8-c.p. lamps connected	85,126	72,209
Units sold	3,206,420	2,628,476
Maximum load	1,674 kw.	1,460 kw.
Average price obtained for all purposes	1·78d.	2·02d.

During the year a substantial reduction in price was made to the Tramways Committee, being equivalent to a reduction in revenue of £1,579; there was also an increase of £579 in the assessment. During the past year the output of energy for private lighting and power increased by 27·1 per cent. The amount standing to the credit of the reserve fund is £9,811, £469 having been expended on show rooms.

In an additional report by the Committee it is stated that in consequence of the rapidly increasing demand for electricity, the question of increasing the capacity of the plant at the Commercial Road station to cope with the anticipated demand of the coming winter has been considered. The total capacity of the plant installed at Commercial Road amounts to 2,200 kw. In addition to this there is an auxiliary supply from the refuse destructor with a maximum normal capacity of 250 kw. The engineer had prepared a scheme for increasing the capacity of the station as follows:—

600-kw. generating set, with triple-expansion engine, estimated cost	£2,600
Surface condenser to deal with 20,000 lb. steam per hour; with pumps, &c.	1,100
Piping, &c.	150
Additions to switchboard	680
Contingencies, 5 per cent.	227
Total	£4,757

In regard to these extensions, see our "Contracts Closed" column to-day.

TRAMWAY and RAILWAY NOTES.

Accidents.—On Saturday morning last two West Ham Corporation cars came into collision, injuring four passengers and one of the motormen.

A L.U.T. car ran into the back of a motor-omnibus on Sunday afternoon, owing, it is said, to the 'bus suddenly stopping in front of the car. The staircase was so badly smashed that it was necessary for another omnibus to draw alongside, to enable the passengers to alight by climbing over the rail.

Aldershot.—We understand that the Light Railway Commissioners will grant an order authorising the construction of tramways between Aldershot, Ash and Farnborough. With the permission of the War Office, the tramways will traverse the whole length of the Queen's Avenue, which passes through the military camp, and connects Aldershot with Farnborough. At the express desire of the military authorities, the promoters propose to carry the tramways through North Camp for the convenience of troops attending the Ash ranges.

Bombay.—According to a long letter from Mr. W. G. Bingham, published in the *Financial Times* recently, it appears that that gentleman, the original concessionaire for the tramway and electric lighting scheme, protests against the action of the Corporation of Bombay in transferring the concession to the Brush Co., and intends to seek a remedy by process of law.

Canada.—Toronto.—It is officially stated that energy from Niagara Falls will be delivered in Toronto by October 1st for the purpose of supplying the Street Railway Co. Preliminary tests were recently made with the plant and transmission system from the Falls, and also with the step-down machinery at Toronto. The results were regarded as highly satisfactory.

Grand Trunk Railway.—The electric plant to be used to light the St. Clair tunnel is about to be installed, the cost being about $700,000.

Hamilton.—The Brantford and Hamilton Electric Railway and the Hamilton Galt and Guelph Railway have been granted an extension of time in which to inaugurate their proposed systems by the Hamilton Municipality. The company have agreed to deposit a guarantee bond of $10,000 and to spend $200,000 on constructional work before November 1st of this year.

Chatham.—A check to the progress of extension by the Chatham and District Light Railway Co. has proved only a temporary one, and work is again proceeding. The company, it seems, made arrangements with the War Office to lay rails on certain lands adjoining the main road to Rainham from Chatham, but omitted to come to terms with the tenants. The outcome was that, on July 3rd, the tenants' bailiffs refused to permit a gang of 50 men to enter the field to dig trenches. The men, however, commenced opening up the ground. The contractors were given notice to quit, and as this was not complied with, an injunction was obtained requiring the contractors to remove themselves and their plant from the ground, and to cease from trespass. Mr. Justice Jelf gave defendants leave to show cause on Monday last why the injunction should not be continued, but before then the parties came to terms, and the work is proceeding.

Continental Notes.—SWITZERLAND. — The electrical installation for the railway from Locarno to Bignasco has been entrusted to the Oerlikon Co. The line will be on the metre gauge, and the length 27·5 kilometres. It is stated that 6,000 volts line pressure will be used.

THE RIVIERA.—It is said that a syndicate has been formed with a capital of £5,000 to promote a company to provide an electric tramway system for the Riviera.

AUSTRIA.—Experiments with electric traction are now in progress on a section of the Metropolitan Railway in Vienna. The section concerned is that which connects the Praterstern and the northern railway station. The trials are being made with electric locomotives which are supplied with energy from overhead wires, and each train is composed of from four to ten carriages. The length of line selected for the trials will tax the locomotives to the fullest extent, as the gradient from the head Customs Office to the Praterstern is a tolerably stiff one. If the experiments are successful, it is intended to proceed with the conversion of the whole of the railway to electric traction.

SPAIN.—Preliminary works are being carried out with a view to the construction of an electric tramway between Casa Gomis (Barcelona) and Tarrasa.—*Board of Trade Journal.*

Derwent Valley.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order to transfer the Derwent Valley Light Railway Order, 1902, from Escrick and Riccall R.D.C.'s to a private company.

Erith.—Negotiations are proceeding between the U.D.C. and the L.C.C. relative to the construction of tramways from Abbey Wood to the system at Erith. The L.C.C. has written stating that with the approval of the B. of T. it will construct or reconstruct on the overhead system the lines between Beresford Square and the junction with the Erith system, Erith to run a service of cars between Abbey Wood and Beresford Square. Subject to certain modified conditions, the U.D.C. has signified its approval of the offer.

Farnworth.—The U.D.C. has sealed an agreement with the Kearsley U.D.C. regarding the working of tramways for a period of 21 years from April 1st, 1906. The terms of the lease of the Farnworth and Kearsley tramways to the South Lancashire Tramways Co. for 21 years from April 1st last have also been sealed.

Gloucester.—A member of the T.C. has given notice to move that the Light Railways Committee forthwith enter into negotiations with a company or companies to ascertain upon what terms the tramway undertaking can be disposed of either on lease or otherwise.

Hertfordshire.—The Light Railway Commissioners have granted the C.C. an order to construct tramways in Watford and Bushey up to the Herts border at Stanmore. It is intended to link up eventually with the Edgware and Marble Arch tramways, and so to give the neighbourhood direct tramway access to London.

Hove.—A committee of the T.C. has reported adversely on an inquiry from the B.E.T. Co., as to whether the Corporation is prepared to allow the company to carry their Hove to Worthing tramway after electrification to Hove railway station, or to some other more convenient point than the present tramway terminus.

London. — BAKER STREET AND WATERLOO RAILWAY. In place of the uniform fare of 2d., the company put into operation on the 22nd inst. the ordinary system—the fares now increasing by halfpennies, from 1d. between one or two stations up to 3d. for the whole distance.

GREAT NORTHERN AND CITY RAILWAY. — The company has decided as from August 1st to withdraw the use of 1d. and 2d. book-tickets, co-incidently with the issue of season-tickets from intermediate stations.

CITY AND SOUTH LONDON RAILWAY.—Traffic was stopped on Thursday last week for two hours, between Moorgate Street and the Angel, through the derailment of a locomotive.

CAMBERWELL.—The Works Committee of the B.C. has recommended that the L.C.C. be informed that it will object to the overhead system being used in Denmark Hill, but will have no objection to that system in Coldharbour Lane and Norwood Road. It further recommends the widening of Norwood Road by taking in a portion of Brockwell Park.

FULHAM.—In reference to the proposed construction of tramways along the Fulham Palace Road, the L.C.C. suggests that the paving between the rails shall be of granite, but the B.C. contends that wood blocks should be substituted. The representations of the Fulham B.C. are upheld by the Hammersmith B.C. It is probable that if Fulham does not agree to the laying of granite the scheme will be abandoned.—*Tribune.*

ISLINGTON.—Having regard to recent tramcar accidents in Archway Road, the Works Committee has recommended the B.C. to direct the L.C.C.'s attention to the necessity of widening, as a metropolitan improvement, Archway, Holloway and Junction Roads, as well as Highgate Hill, at the point where these roads converge on the tramway terminus.

METROPOLITAN RAILWAY.—Nine electric locomotives are now being used to haul the company's City and Hammersmith trains as far as Bishop's Road. It is expected that the section between Bishop's Road and Hammersmith will shortly be ready for electric running.

L.C.C.—The Highways Committee has submitted a report recommending that that portion of the tramways over Westminster Bridge to the proposed junction with the subway at Waterloo Bridge should be put in hand with the least possible delay, in order that it may be in operation, if possible, before the end of the present year. The extension of the subway itself, which will cost £209,000, cannot be completed for some time. The cost of the trackwork and the necessary cables and cable ducts is estimated at £96,500. The Committee recommends that, instead of inviting fresh tenders for the work, the existing tenders in connection with the tramways should be extended.

Capt. Hemphill (chairman of the Highways Committee) has stated that the Council's Tramways and Improvements Bill, which authorises the construction of tramways over Westminster Bridge and along the Victoria Embankment, will receive the Royal Assent on August 4th.

The Highways Committee has recommended that the employés taken over with the northern tramways from the North Metropolitan Tramways Co. be placed upon the Council's standard conditions of labour as from October 1st next. The cost of making these alterations, including the employment of additional men who will be required in consequence of the shortening of the hours of labour, will amount to about £15,658 per annum.

The Finance Committee, in the course of a report dealing with the audit of the Council's accounts for 1904-5, stated that the auditor drew attention to the method of arriving at the amount set aside for future renewals of the tramways, and to the manner in which the cost of certain street improvements in connection with tramways was apportioned as between the improvement account and the tramways account. With regard to the question of renewals, the Committee stated that it was in communication with the Highways Committee with a view to the adoption of a well-defined basis for the sums to be calculated for the purpose. The second point was also under the consideration of both Committees and the Improvements Committee, and reports on both questions would be presented to the Council in due course.

The long discussion which ensued was largely devoted to emphasising the criticisms passed by the L.G.B. auditor, and resulted in some heated comments. In terminating the discussion, Lord Welby remarked that, according to a report before the Finance Committee, a sum of rather more than 1d. per car-mile would have to be appropriated for renewals, and the fund would be brought up to the equivalent of that amount. The sum now needed was from £30,000 to £40,000, and it would be made up in future years.

The Council postponed for a week the consideration of various recommendations in regard to the proposed construction of tramways from Westminster Bridge Road *vid* Westminster Bridge and Victoria Embankment to a point near John Carpenter Street with connections at Waterloo Bridge with the projected tramway subway, and at Stangate with the Battersea and Wandsworth tramways. An expenditure of £7,500 was sanctioned for the purchase of two alternating-current motors for the sub-station at the Elephant and Castle.

The Highways Committee, in reporting on systems of electric traction for the reconstruction of existing tramways and the construction of new lines, asked for authority to communicate with the B. of T. and the borough councils concerned, with a view to the adoption on the following lines of the system specified in each case :—

Route of tramways.	System of electric traction.
1. Existing lines from Commercial Road (near Aldgate terminus), *via* High Street, Whitechapel and Whitechapel Road, to Cambridge Road	Conduit.
2. Existing lines from Cambridge Road, *via* Mile End Road and Bow Road, to Bow Bridge	Overhead.
3. Existing lines from Highbury (N.L.R.) station, *via* Holloway Road, to the Archway Tavern	Conduit.
4. Existing lines from High Street, Shoreditch, *via* Hackney Road, to Cambridge Heath	Conduit.
5. Existing lines from Old Street, *via* City Road, to the Angel, Islington	Conduit.
6. Existing lines from Euston Road, *via* Hampstead Road, to the L. and N.W.R. bridge in Hampstead Road, near Ampthill Square	Conduit.
7. Existing lines from the L. and N.W.R. bridge in Hampstead Road, *via* that thoroughfare, High Street, Camden Town, Camden Road, Parkhurst Road, and Seven Sisters Road, to Finsbury Park	Overhead.
8. Existing lines from terminus in Aldersgate Street, *via* Goswell Road to the Angel, Islington, except the lines in Goswell Road which the Council has already decided to reconstruct for electric conduit traction	Conduit.
9. Existing lines from High Street, Camden Town, *via* Chalk Farm Road, Ferdinand Street, Malden Road, Southampton Road, Fleet Road, Agincourt Road, and Constantine Road, to the Hampstead terminus	Overhead.
10. Existing lines from Whitechapel Road, *via* Cambridge Road, Cambridge Heath, Mare Street and Lower and Upper Clapton Roads, to Stamford Hill	Conduit.
11. Existing lines from Nine Elms Lane, *via* Wandsworth Road, Lavender Hill, and St. John's Hill, to East Hill, Wandsworth	Conduit.
12. Existing lines to be purchased from the London Southern Tramways Company, from Vauxhall Station, *via* South Lambeth Road and Stockwell Road, to and across Brixton Road	Conduit.
13. Existing lines to be purchased from the London Southern Tramways Company from Brixton Road, *via* Gresham Road and Coldharbour Lane to High Street, Camberwell, and from Coldharbour Lane, *via* Milkwood Road and Norwood Road, to the terminus at Lower Norwood	Overhead.
14. Partly existing lines and partly new lines from Beresford Square, Woolwich, *via* Plumstead Road, High Street, Plumstead, Bostall Hill, McCleod Road, Basildon Road and Bostall Lane, to the county boundary at Abbey Wood	Overhead.

Huddersfield.—A Conciliation Board has been established for the purpose of determining differences which may arise between the Corporation and the employés other than salaried officials on the tramways, viz., (1) as to rates of wages; (2) as to hours of labour; and (3) differences of a serious nature not being matters which fall within the authority of the tramways manager to settle. The Board is to consist of eight members, four representing the Corporation the Mayor being the Chairman of the Finance Committee for the time being, and two members of the Tramways Committee nominated by the Corporation; and four representing the employés, being the president at the time of the Amalgamated Association of Tramway Workers, Mr. G. F. Jackson, the general secretary of the association, or other general secretary for the time, and two members of the association. It is provided that no matter shall be submitted to the Board until it has been considered by the Tramways Committee and agreed upon, or remitted by it to the Board in the event of non-agreement within twenty-eight days of the matter being brought to the notice of the Board.

Lancaster.—The Tramways Committee is endeavouring to abolish ½d. fares. The passengers on the ½d. stages last year represented 45 per cent. of the traffic.

Light Railway Orders.—The B. of T. has recently confirmed the following orders made by the Light Railway Commissioners:—(1) Barking Light Railways (Lands) Order, 1906, authorising the Barking U.D.C. to take lands for the purpose of widening a road on which a light railway will be laid; (2) North Lindsey Light Railways (Extensions) Order, 1906, authorising the construction of light railways in Lindsey, from Winteringham to Barton-upon-Humber and from Whitton to Alkborough.

Penrith.—Mr. S. W. Ball, the clerk to the Willesden U.D.C., was to read a paper on "The Rating of Light Railways," at the Conference of Urban District Councils, which opened at Penrith on the 19th inst.

Shildon.—The United Kingdom Electric Tramway Syndicate has applied to the B. of T. for another year's extension of the tramway order.

Smethwick.—The Empire E.L. & P. Co. has asked the T.C. to grant permission for an electric tramway to be constructed through the borough from Halesowen to Birmingham.

South America.—Rosario.—Work is progressing in connection with the electrification of the tramways in the town, and the company hopes to have one section in operation by August.

U.S.A.—Connecticut.—A new company with a capital of £500,000 has been formed to hold the stock of the Westchester Lighting Co., and to take over the chief lighting and traction concerns in N.W. Connecticut.

New York City.—The Manhattan Elevated Railroad has recently constructed a third track along a portion of Third Avenue. The city authorities have not given permission for this addition, and law suits have been instituted to compel the removal of the new track.

Engineering difficulties of a serious nature have developed in each of the three under-river tunnels intended for electric traction between New York and Brooklyn. The roof of the interborough tunnel has become depressed, and to allow for sufficient headway for the cars, the lower plates are being taken out and relaid a few inches lower. The Long Island and Pennsylvania Railroad tunnel (which is really four separate tubes, the contract for which is in the hands of the English engineering firm of S. Pearson & Son) has developed faults due to its closeness to the bottom of the river; and the Belmont tunnel has experienced trouble due to the air pressure. Labour difficulties have also threatened to delay the construction.

Mr. F. B. Behr recently spoke on proposals respecting a local mono-rail at Brooklyn on July 9th, and Mr. Ramsey, an official of the Wabash Railroad, gave some guarded support to the scheme as affecting Brooklyn.

West Ham.—The total working expenditure on the tramways undertaking for the year ended March 31st last was £32,069, or about 7·112d. per car-mile. Included in the foregoing is an amount of £3,268, representing the balance of the cost of a temporary car-shed. The total cost of these temporary buildings was £5,818, and the total balance outstanding has been charged against the revenue account for the past year. The total income amounted to £100,474, and the gross profit to £38,405. After paying interest and sinking fund charges, &c., there remained a balance of £18,680; £8,000 is to be put to the relief of the rates, £2,410 against the cost of widening Green Street, and £8,270 to the reserve fund. The total expenditure on capital account amounted to £438,072, the expenditure during the past twelve months being £149,728. It was reported that the cost of carrying out contract No. 2 of the tramways by the works department was £33,242, or £3,819 above the valuation. The works manager's tender for this, which was accepted, was £27,147, and the next lowest tender, which was Messrs. Dick, Kerr & Co.'s, was £29,064. Mr. George Wise, the works manager, in a long report set out that the net extra cost of the works department above the lowest contractor's price was £1,741. Upon the suggestion of the Leyton Tramways Committee the tramway managers of the two districts are to meet and draft a scheme for through running.

Swinton and Pendlebury.—The work of laying the Lancashire United Tramways Co.'s lines at Swinton has been temporarily suspended owing to a dispute. The company claimed that it was empowered by the terms of the Act to break up the setts taken up during the construction of the track, and to use the material for concreting; the Act providing that it should reinstate the roadway with the material taken up. The alleged rights in this matter are disputed by the County Council and the Swinton and Pendlebury U.D.C. The work of laying lines has not been interrupted in Worsley township. Arguments on both sides were advanced recently before Mr. Thomas Ekin, who attended at the Swinton Council offices as the referee appointed by the B. of T. He reserved his decision.

TELEGRAPH and TELEPHONE NOTES.

Brighton.—In the course of the negotiations for the sale of the Brighton Corporation telephone system to the Government, it has been pointed out that the underground ducts within the town of Hove have been sold to the Hove T.C. The value of the work amounts to several thousand pounds, and the Postmaster-General, according to a correspondent of the *Sussex Daily News*, wishes to deduct this from the already low price offered.

Canada.—The Canadian Pacific Railway has installed a special copper wire between Winnipeg and Montreal, touching only Fort William and North Bay, for its new system, by means of which two messages—one by telephone and the other by telegraph—can be transmitted over the wire at the same time. According to the *Manitoba Free Press* the operators at Montreal are able to converse with those at Winnipeg by telephone, while the operators in the Fort William office are sending a message over the same wire to Montreal, proving the success of the system. The distance is over 1,000 miles, and it is claimed to be the greatest distance human speech has ever been carried over a wire.

Chinese Telephony.—Among the things destroyed by the San Francisco earthquake, says the *Manchester Courier*, was one of the most curious telephone exchanges in the world, the Chinatown exchange, which had about 900 Chinese subscribers. The jacks were not numbered for subscribers, but were each assigned by name to its owner. The reason for this was that the names and letters of the Chinese numerals were so long. Thus, though No. 808 might be Mr. Sang Fat, his number would be in Chinese "bat-bak-soh-gow-bat," and could not be printed in any shorter way. But more curious than this was that the names themselves did not appear on the board in the exchange but in the directory alone, and the telephone exchange operator had to remember, and did remember, which jack belonged to each subscriber. There were 16 operators, working in two shifts of eight each, so that each operator had to keep in his mental vision a picture of rather more than a hundred jacks with the respective names. When one subscriber wished to call another he merely repeated the name of the latter to the exchange. Even with this curious system the service was quick and trustworthy. The Chinese were rather slow to adopt the telephone, and it is said that not a few of them believed that they must blow into the transmitter to call the central office. The Chinaman would never mention the dead, or sacred things, in talking over the wire.

Iceland.—The Great Northern Telegraph Co. states that Iceland and the Faroe Islands will shortly be telegraphically connected with this country. The cable will be laid in two sections, the first from the Shetlands to the Faroe Islands (Thorshavn), which is expected to be completed by the end of this month, and the second from the Faroe Islands to Iceland (Seydisfjord) towards the end of August. A system of land lines is being built by the Icelandic Government, but is not expected to be completed before October 1st.

Italy.—The new telephone line of the Societa Telefonica Vigevanese from Mortara *via* Vigevano and Abbiategrasso to Milan has recently been opened to traffic. This line gives communication with a large number of important cities.

Mexico.—The German Consul at Mazatlan reports that proposals are on foot for better means of communication with Lower California by the utilisation of wireless telegraphy. A line of this description between Guaymas and Santa Rosalia is now in operation, and up to the present has given every satisfaction; it is open for public communication. A second service is now immediately proposed, between Mazatlan and San José del Cabo, in the southern point of Lower California, and it is proposed later to erect a telegraph wire from Santa Rosalia to San José del Cabo along the coast.

Overhead Telegraph Wires.—The opposition on the part of local authorities to the use of overhead wires by the Post Office authorities continues to give trouble. Last week, at Woolwich and Stoke Newington, cases were decided in favour of the Postmaster-General, and at Kingston-on-Thames in the previous week a settlement was made whereby the Postmaster-General agreed to put the wires underground when they exceeded 32 in number on one line of poles.

New Pacific Cable. — The ss. *Urmston Grange*, chartered by Messrs. Siemens Bros. & Co., and fitted up for cable laying, returned on July 1st from the Pacific, where she has laid 900 miles of cable from the American island Guam to Peel, a small island in the Bonin group which belongs to the Japanese. The shore end was landed at Guam on March 28th, and the final splice made on April 8th. Guam has cables to Yap island and Manilla which are connected to Shanghai, and another cable to Midway island which connects with San Francisco *via* Honolulu. Bonin has recently been connected to Yokohama by a cable of English manufacture which the Japanese Government has been laying with its own cable-ship, the *Okinawa Maru*, which was built in Glasgow. The *Urmston Grange* is one of the Houlder line; she has a registered tonnage of 2,213, and a speed of from 9 to 10 knots. The work was finished in twelve days without the least hitch, and the signals through the cable when laid were excellent.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Reissa-Issa (Yemen) Camaran	Oct. 29, 1902	
Cayenne-Pinheiro	Aug. 18, 1902	
Port Arthur-Chifu (Closed)	Mar. 7, 1904	
Tarifa-Tangier	Jan. 18, 1904	
Garachico (Tenerif)-Santa Cruz	July 12, 1906	
Bolamo-Bissao	July 24, 1906	
Landlines.		
Puerto-Barrios	Aug. 28, 1902	
Bachkale-Deliman	Feb. 12, 1906	
Trebizonde-Batoum	July 15, 1906	July 18
Bagdad-Bassorah	July 17, 1906	

West Australia.—The Mining Managers' Association has reported favourably on the Neville patent system of electrical signalling in mines, which indicates to the engine driver exactly the level at which the cage is required, and enables him to communicate with the cage, saving much time and ensuring increased accuracy and safety.

Wireless Telegraphy. — The French Consul at Honolulu reports that the chief Hawaiian Islands are in communication by means of a system of wireless telegraphy. A central station at Barber Point, 20 miles from Honolulu, is connected with the office in the town by means of an aerial wire. This central station communicates with three similar stations, one at Lahaina (Maui), distant 75 miles, one at Puako, Keawenui (Hawaii), 140 miles, and the third at Nawiliwili (Kauai), 98 miles; all these stations are in direct communication with the several telephone lines which serve the islands, and with a telegraph line by aerial wire to Hawaii. The cost of messages is a minimum of $1½ for ten words and 15 cents for each additional word. The Marconi system is used with improvements specially invented and patented by Mr. Cross, director of telegraphs for the Hawaiian Islands. The naval station of the United States had also its system of wireless telegraphy, similar to those established by that Government in all its ports for communicating with battleships; but that which is installed at Honolulu is in a less happy position owing to the fact that communication is somewhat interrupted by the neighbouring mountains. The federal government proposes, it is said, to install a very complete and powerful station at Loma Point, San Diego (California), on a tower 150 ft. high which will communicate directly, it is hoped, with a similar apparatus which will be installed on a height on the island of Molokai, whence messages can easily be dispatched to Honolulu. A private enterprise is also said to be proposed to establish direct communication between an apparatus fixed on Mount Tamalpais, behind San Francisco, and another to be erected on a peak behind Honolulu, or on the point of Kahuku, a total distance of about 2,150 miles.

M. Edouard Branly, says the *Daily Telegraph*, who is generally credited in Paris with having been the real inventor of wireless telegraphy, has just patented an important improvement by which interception of messages will be rendered impossible, except by a special apparatus. At present, M. Branly states, it is a popular delusion to imagine that wireless telegraphy could render any service in time of war across country or seas held by an enemy. The latter can, with the greatest ease, either intercept messages, or so disturb their transmission as to render them incomprehensible. M. Branly claims that his new apparatus ensures for a given set of electric waves complete immunity from accidental interference of other waves. But, at the same time, it will always be possible in time of war to disturb messages wilfully, even when sent off by his new appliance. He says that no wireless telegraph system known is proof against interference if a special mechanism giving out waves uninterruptedly be used to that end. His final conclusion is that for war purposes on land or at sea "the usefulness of wireless telegraphy would be illusory."

Colonel Sir Henry Hozier, secretary of Lloyd's, has resigned his post, and it is rumoured that a proposal is on foot for the Government to acquire the signalling stations of that organisation. The new secretary is Capt. E. F. Inglefield, R.N.

An Ordinance has been issued constituting wireless telegraphy a Government monopoly in the Sudan. It is provided that no person shall install or make use of any apparatus for wireless telegraphy, or transmit or receive messages by means of any such apparatus within the Sudan, without a special licence from the Governor-General.—*Board of Trade Journal.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—According to the *Australian Mining Standard* tenders are invited as below:—

South Australia.—September 19th. Sundry telephone materials.

New South Wales.—October 24th. Postmaster-General's department. Five sections common battery switchboard and 500 telephones.

Queensland.—August 27th. Postmaster-General's department. 21½ tons copper wire, 200-lb., H.D.; 4,700 copper tapes for 200-lb. wire; 4,700 copper binders for 200-lb. wire; 600 McIntyre sleeves; 5,350 insulators, Acme; 2,386 bolts for arms.

October 24th. Five sections common battery switchboard and 500 telephones.

Victoria.—August 7th. Postmaster-General's department. Supply 20,000 Western Union pattern double-shed single-groove glass insulators and 5,000 double-groove glass insulators.

Belgium.—July 30th. The Belgian Direction Generale des Ponts et Chaussées, 8, Rue de Louvain, Brussels, is inviting tenders until the 30th inst. for an installation of electric lighting in the Cour d'Appel at the Palais de Justice, Brussels.

Bolton.—August 9th. Two Lancashire boilers for the electricity department. See "Official Notices" July 20th.

Darlington.—July 31st. Uniforms for tramway employés. See "Official Notices" July 20th.

Dublin.—July 30th. Electric lighting of the Main Drainage Pumping station for the Corporation Improvements Committee. Specifications, price 10s. 6d., from the City Electrical Engineer, Fleet Street, Dublin.

Dudley.—August 13th. Feeder and distributor cables for the Electricity Department. See "Official Notices" to-day.

Glasgow.—August 1st. The Bathgate District Committee desire offers for laying 1,170 yards of electric cable. Specifications from J. G. B. Henderson, District Clerk.

Gloucester.—August 9th. Stores for the Light Railways Committee. See "Official Notices" to-day.

Greenock.—August 7th. Coal, engine room stores, and electricity meters for the electricity department. See "Official Notices" to-day.

Leeds.—August 15th. Steam and other piping for the electricity department. See "Official Notices" July 20th.

Newport.—July 27th. Coal and stores for the electricity department.

Portsmouth.—August 6th. Welsh steam coal for the Tramways Committee. See "Official Notices" to-day.

Roumania.—August 3rd. The municipal authorities of Roman are inviting tenders until August 3rd for the concession for the electric lighting of the town.

Shanghai.—July 31st. Two 600-kw. steam turbo-dynamos or steam dynamos, condensing plant, motor-generator, switchboard, water-tube boilers, &c., for the Municipal Council. See "Official Notices" July 13th.

Spain.—The municipal authorities of Salamanca have just invited tenders for the concession for the electric lighting of the town for a period of ten years.

Stockport.—August 11th. Water-tube boiler, superheater and stoker, for the electricity works. See "Official Notices" to-day.

Stoke-upon-Trent.—August 4th. Water-tube boiler for the electricity Committee. See "Official Notices" July 20th.

Sunderland.—July 27th. Two 250-kw. synchronous motor-generators, and high and low tension switchgear, for the Corporation. See "Official Notices" July 6th.

Sutton.—August 1st. The Metropolitan Asylums Board is inviting tenders for an electric lighting installation at the Downs School, Banstead Road. See "Official Notices" July 20th.

Sweden.—July 31st. 200,000 kilos. of copper wire of 3 mm. thickness, and 100,000 kilos. of copper wire of 4·5 mm. thickness, for the Swedish State Telegraphs. Sealed tenders, marked "Anbud a Koppartrad," should be addressed to "Kungl. Telegrafstyrelsen, Stockholm." Specification and form of tender may be seen at the offices of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Warrington.—July 30th. Telescopic ladder tower, also overhead wire reel wagon, for the Warrington tramways department. See two "Official Notices" July 13th.

CLOSED.

Hastings.—The T.C. has accepted the tender of Messrs. Oliver & Co. for the supply of 104 "Oriflamme" arc lamps, with contact raising and lowering gears, transformers, economy coils, switches, and other accessories, at £1,848.

Heaton Norris.—The U.D.C. has accepted the tender of Messrs. G. H. Scholes & Co., of Manchester, for the installation of the electric light at the Council Offices.

Herts.—The C.C. has accepted the tender of Messrs. Dick, Kerr & Co. for the construction of the Barnet Light Railway, at £21,652.

London.—Westminster.—The City Council has accepted the tender, at £534, of Messrs. Speedy, Eynon & Co. for re-wiring the Caxton Hall. Thirteen selected firms tendered.

London.—The Metropolitan Railway Co. have accepted the tender of Messrs. Johnson & Phillips, Ltd., for the supply and erection of the electrical plant at their Neasden Yard.

Bermondsey.—The Council has accepted the tender of Messrs. Johnson &, Phillips, Ltd., for the supply and erection of arc lamp lowering gear for all the lamps in the borough.

L.C.C.—The Highways Committee of the L.C.C. propose to accept the following tenders, as an extension of existing contracts, in connection with the construction of the tramways between Westminster Bridge Road and the Victoria Embankment:—

Siemens Bros. Dynamo Works, Ltd.—Motor-generators, £5,000.
Ferranti, Ltd.—High and low-tension switchgear, £2,700.
Eckstein, Heap & Co.—Low-tension switchgear, £700.
J. Smith (Keighley), Ltd.—Overhead travelling hand cranes, £270.
Reid Bros.—Laying of cable ducts, £4,500.
Bolckow, Vaughan & Co.—Track rails, &c.
Frodingham Iron & Steel Co.—Conductor tee rails } £7,500.
Steel, Peech & Tozer, Ltd.—Slot rails, &c.
Western Electric Co.—High-tension cables, &c., £10,500.
W. T. Henley's Telegraph Works Co.—Low-tension cables, &c., £6,500.

It is proposed to procure the special trackwork from the Hadfield Steel Foundry Co. for a sum not exceeding £6,520.

Marylebone.—The B.C. has provisionally accepted the following tenders:—

Union Electric Co., Ltd.—171 arc lamps for Oxford Street, £915; 160 globes, £28 15s.; 50 spare economisers, 15s.
H. Windsor & Co.—Structural alterations at Rathbone Place sub-station, approximate estimate, £500.

Loughborough.—The Corporation Electricity Department has placed orders for the year's supply of stores with the following firms:—

Oils .. .. The Valvoline Oil Co.
Engine room stores .. .. Fredk. Mountford, Birmingham.
Cables and cable accessories .. .. W. T. Henley's, Ltd.
House service meters .. .. .. Venner & Co.
Motors .. .. Industrial Engineering Co.
Turbo-generator brushes .. .. .. Brush Electrical Engineering Co.

Mansfield.—The T.C. has accepted the tender of the D.P. Battery Co. for the supply of a battery at £1,631 10s.

Mexborough.—The U.D.C. has accepted the tender of Callender's Cable & Construction Co. for the supply of 10 tons of refined Trinidad bitumen, at £5 15s. per ton.

Warwickshire.—The C.C. has been recommended by the County Buildings Committee to accept the tender of Messrs. Jas. Plucknett & Co., of Warwick, for the installation of the electric light at the Shire Hall, Warwick, at £500.

West Ham.—The Corporation has received the following tenders for high-tension switchgear:—

British Thomson-Houston Co.	(accepted)	£985	
British Westinghouse Electric Co.		1,265	£1,077
Ferranti, Ltd.		1,079	
Cowans, Ltd.		1,423	
General Electric Co.		1,342	
Siemens Bros. & Co.		1,080	

The Corporation has also accepted the tender of the British Westinghouse Co. for step-up transformers, at £243 10s. each, and the tender of the British Electrical Transformer Co. for step-down transformers, at £59, £98 and £127 each, respectively. They have further accepted the tender of the British Insulated & Helsby Cables Co., Ltd. (at a price not stated) for the supply of high-tension cable required for the Silvertown extension.

Willesden.—The D.C. has accepted the tender of Messrs. Newtons, Ltd., for the supply of motors.

Wolverhampton.—The Electricity Committee, as a result of an advertisement for tenders for extension of plant at the Commercial Road station, has recommended the following for acceptance:—

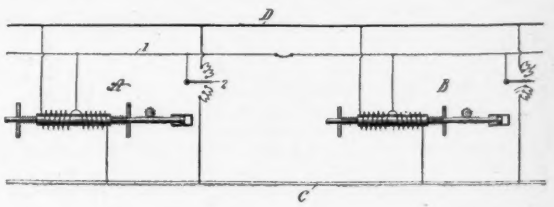
Belliss & Morcom.—One high-speed triple-expansion engine, £1,850.
T. Parker, Ltd.—One multi-polar generator, £695.
Mirrlees Watson Co.—One condensing plant, complete with circulating pumps, air pumps and oil separator, £1,095.

FORTHCOMING EVENTS.

Saturday, July 28th.—At 11 a.m. Association of Engineers-in-Charge. Visit to the engineering department of the Houses of Parliament.
Wednesday, August 1st.—British Association. Meeting opens at York.
Wednesday and Thursday, August 1st and 2nd.—North of England Institute of Mining and Mechanical Engineers. Excursion meeting. Members of Am. I. Mining E. visiting this country at the invitation of the Iron and Steel Institute will take part.

NOTES.

Single-Wire Multiple-Unit System.—According to the *Street Railway Journal*, an ingenious method of operating a multiple-unit train by a single train wire has been patented by H. McL. Harding and Charles M. Martin, of New York. As is well known, all previous multiple-unit systems have required two or more train wires, and in some cases the connecting cable had to be manufactured with a large number of conductors. The tendency towards high voltages suggested to the inventors the desirability of reducing the number of pilot wires, and this has finally been accomplished by their reduction to a single wire. The method of attaining this result is shown by the accompanying figure, in which D is the third rail, or trolley wire; B is the motor-car; A is the second car in the train; C is the return circuit, and 1 is the pilot wire. Each car is supplied with one or more solenoids differentially wound and with the middle point of the winding connected with the pilot wire. The master controller is at 2, and consists of a switch with resistances, so that the middle point of the solenoid winding can be connected either to trolley wire or earth. The operation of the system will then be easily understood. When the master controller switch is at zero position, current flows through the differential winding from the trolley



wire to ground and produces no effect on the solenoid. When the pilot wire is connected to the trolley voltage, the left half portion of the solenoid winding on each car is out of circuit and the solenoid plunger is thrown forward. When the master controller switch is connected with earth, the right-hand side of the differential solenoid winding is out of circuit and the plunger is thrown backward. When the master controller is shifted to the zero position, the plunger returns to its original position. The figure shows a method of operating the car controllers from the solenoid plunger by means of a rack and pinion, and of regulating the throw of the plunger by the dash-pot, and by varying the resistance at the master controller. It is stated in the patent, however, that this is simply one possible method, and the claims cover the method of controlling any kind of motor circuit on the car and securing forward, stop, reverse, or any intermediate condition of the motors by changing the potential of the single pilot wire.

The Brush Co. at Play.—On Saturday last week, in weather alternately pleasant and threatening, the third annual athletic meeting of the Brush Electric Engineering Co. was held in the Hockey Ground, Park Road, Loughborough. As on previous occasions, the London contingent, with a few friends, journeyed down by the ten o'clock train from St. Pancras, and again the ladies of the town staff graced the gathering with their presence. We find it impossible to enter into details of the 16 events which figured on the sports programme, but we cannot refrain from mentioning two. The 440 Yards Handicap Flat Race and the 100 Yards Handicap for Veterans were both won by Sergt. W. H. Snelling, who in his heats and finals ran with excellent judgment and pluck. For his victory in the shorter race the gallant ex-soldier was probably indebted to the absence from the scene of his former triumphs of Mr. George Offor. The surprise of the day, however, occurred in the third heat of the Obstacle Race. The competitors had to run a certain distance, crawl under a length of netting stretched upon the ground, run again to a spot where each man had to catch hold of a wheelbarrow and draw it after him for some distance, then get into sacks and proceed as best they could, divest themselves of these encumbrances, run to a row of water pails, in each of which floated an apple, seize the apple with the teeth, and make for the winning post. This heat was won by a small boy whose stategy and manœuvring were worthy of the highest praise, especially the manner in which he grabbed the apple by getting it down on the bottom of the pail while the others were vainly endeavouring to capture the elusive fruit as it floated and bobbed about on the surface. We had to leave before the final was run off, the proceedings dragging somewhat, but that youth may eventually become managing director of the company, unless he develops into a "land grabber." The music was provided by the same band as of yore, but the result in several instances rather indicated that a system of handicapping was desirable, although we did not notice anybody sucking lemons. Anyhow, as one of our party remarked to the bandmaster, "you don't perform to-day as if you Lovett!" But selections such as "A Trip to Blackpool," "The Stars and Stripes for Ever" (in compliment, we were unofficially informed, to the Westinghouse Co.), "The Spring Chicken," &c., are hardly calculated to imbue even volunteer bandsmen with much enthusiasm in the performance of the divine art. The cornet solo "Sing me to Sleep" had its effect upon the editor of one of our contemporaries, a high compliment to the art of the player. The sports judges were Messrs. J. J. Steinitz, Col. Hilton, N. H. White, T. C. Elder, A. T. Brotherton,

C. G. Hinde, A. B. Cook, and A. W. Jones; referee, Mr. A. W. Fisher; starter, Mr. T. Trees; timekeeper, Mr. C. Lucas; field stewards, Messrs. W. Muir, H. Hickling, H. Sharpe, F. W. Hersey, W. Dewick, J. Smith, J. J. Cardwall, and R. C. Roberts; sports superintendent, Mr. J. S. Turner; and treasurer, Mr. E. A. Denne. Lest we forget, we would here remark that honourable mention is due to the ubiquitous lady who presides over the destinies of great and small in the Falcon Works. Here, there and everywhere, like a ministering angel, at one time looking after the ladies from town, at others the observed of all observers on the field of action, Miss Fraser won the hearts of the human race completely.

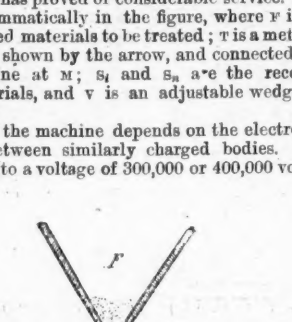
> "O woman! lovely woman! Nature made thee
> To temper man; we had been brutes without you,
> Angels are painted fair, to look like you."

We missed the more picturesque football field adjoining the works in which the sports were formerly held, but this has been given up to the more stern duties of life, and new buildings now occupy a goodly portion of that aforetime pretty playground; but we refer in another column to the Brush Co. at work.

To Mr. Elder, Mr. Pritchard and to other members of the London staff we offer our thanks for the arrangements made for our comfort, and we congratulate everybody concerned on another highly successful athletic gathering.

An Electrostatic Ore Separator.—The useful operation of the well-known magnetic separator is confined to a small range of materials, viz., the separation of magnetic from non-magnetic substances. With a view to extending the same type of treatment to other materials, an electrostatic separator has been introduced, and has proved of considerable service. Its arrangement is shown diagrammatically in the figure, where F is a hopper containing the mixed materials to be treated; T is a metal drum rotating in the direction shown by the arrow, and connected to an electrical influence machine at M; S_1 and S_2 are the receptacles for the separated materials, and V is an adjustable wedge for aiding the separation.

The action of the machine depends on the electrostatic repulsion which exists between similarly charged bodies. The drum T is highly charged (to a voltage of 300,000 or 400,000 volts) by means of



a multiplate influence machine M, and the mixed material, falling on this drum, becomes more or less charged according to its electrical conductivity. The well conducting material becomes highly charged, and is strongly repelled by the drum, so that it falls into the distant receptacle S_1, whilst the badly conducting or non-conducting part, N, of the mixture becomes only slightly charged and falls practically vertically off the drum.

By adjusting the speed of the drum and the value of the applied voltage, it is possible not only to separate actual conductors from non-conductors, but even to separate conductors or non-conductors possessing slight differences of conductivity.

The machines already installed have been constructed in wood, and the power required to drive both the drum and the influence machine does not exceed ¾ H.P.—*Zeitschrift für Elektrotechnik und Maschinenbau.*

Electricity v. Gas for Lighthouse Illumination.—We publish in our "Correspondence" columns a letter on this subject which, while it has the appearance of a correction, nevertheless admits the accuracy of the note in our issue of the 13th inst. We may point out that the paper quoted was read in November, 1900; hence the word "recent" which occurs in the quotation relates to the events of last century. Granted that the ordinary arc light is not the best for foggy weather—we now have the flame arc, giving a rich orange light; and we believe that this will be found the light *par excellence* for lighthouses.

Negligent Car-Driving.—A motor-man named Kelly, in the employ of the Dublin United Tramways Co., has been sent to trial on a charge of having caused the death of a child through negligent driving of his tramcar.

Aeronauts and Overhead Wires.—Recently a French aeronaut named Lacomte made an ascent from Rueil, but got into difficulties, and the balloon sank so low that it became entangled in some overhead mains. According to the *Globe*, the wires were short-circuited and set fire to the balloon, which collapsed, and the aeronaut was thrown to the ground—fortunately escaping without injury. This is the second accident of the kind that we have recorded.

Institution and Lecture Notes.—THE ASSOCIATION OF ENGINEERS-IN-CHARGE.—Through the courtesy of Mr. H. Tomlinson-Lee, chief electrical engineer to the Wimbledon Corporation, a visit was paid to the Corporation's works, at Durnsford Road, Wimbledon, on Saturday, July 14th. A very large number of members joined the party. After tea, which was thoughtfully provided by Mr. Lee, Mr. Darcy (chairman of the Association) proposed a hearty vote of thanks. Mr. Tomlinson-Lee replied. He spoke of the great pleasure it had afforded him and his staff in being associated with such a representative gathering of engineers-in-charge. One impression he had felt very forcibly that afternoon was that the Association of Engineers-in-Charge was very much alive and bent on doing as much good as possible for its members. There was one point he would like to mention. When the new journal came into existence, *The Engineer-in-Charge*, it was much in demand by charge engineers in electric light stations, who, to a great extent, he believed, thought that the journal was catering for them and them only, and some little surprise was evinced at finding it practically devoted to what he might call the general engineer-in-charge.

Referring to Mr. Tomlinson-Lee's remarks, Mr. Penn pointed out that no fault could be laid at the Association's door if the charge engineers of electrical supply stations did not fraternise with members of the Association. A very inviting letter had appeared in the ELECTRICAL REVIEW of February 17th, 1905, from their present chairman, Mr. Darcy, asking for the co-operation of electrical supply station engineers-in-charge. Some progress was made towards organising a deputation to wait upon the Association, and the editors of the ELECTRICAL REVIEW he knew went to some considerable amount of trouble in the matter. He sincerely hoped that this might be a resuscitation of the idea they had in view. Furthermore, the Association took the first opportunity of amending its rules in such manner as to allow of the introduction of electrical engineers-in-charge into the Association.

NOTTINGHAM AND DISTRICT GUILD OF ELECTRICAL AND MECHANICAL ENGINEERS.—The ninth annual outing of this Guild took place on July 2nd to Huddersfield, a new departure being made this year in visiting a large industrial centre instead of merely devoting the day to pleasure. The Guild, by special invitation from Messrs. J. Hopkinson & Co., Ltd., visited their large and up-to-date works, the visitors numbering nearly forty. They were met at the station by a special electric car (which was placed at their disposal for the day), and conveyed to the works, where directors conducted the members through the various departments. An illustrated account of the works has already appeared in the ELECTRICAL REVIEW. The firm has adopted the 52½ hours week, commencing each day at 7.30 a.m. and working till 6.0 p.m., with a stoppage of one hour at dinner time. On Saturdays working hours are from 7.30 to 12.30; all workmen making a full week receive a bonus equal to 1½ hours' pay. Dinner was provided by the firm at the Queen's Hotel, Mr. F. Hopkinson occupying the chair. A vote of thanks to Messrs. Hopkinson was proposed by Mr. Allen, borough electrical engineer, Loughborough, a vice-president of the Guild, and Mr. A. Hopkinson replied. After dinner, visits were paid to two of the largest cloth factories in the neighbourhood. The car-sheds, power station and electric light station were next seen. Other invitations have been received by the Guild, and arrangements have been made by the Council for several half-day visits to works.

At Dublin on 18th inst. Prof. Barrett lectured on "The Life and Work of Michael Faraday."

East London Railway and Electric Traction.—In his speech at the half-yearly meeting of the East London Railway, Lord Claud Hamilton said that the causes of the decrease in 1905 and in the first half of this year were the same, namely, the non-electrification of their line, the competition of tramcars, motor-omnibuses, and omnibuses, as well as the slackness in the building trade, and the consequent falling off in the carriage of building material. They were in a difficult position so far as the question of electrification was concerned. The Metropolitan Co. had not found it a financial success, and when the report of the District Co. was issued it would be found that, owing to the large increase in its working expenses, the company had suffered in no less a degree than itssister company. They themselves could certainly not undertake any electrification scheme just now, even if they had the power of raising the necessary capital. For the present, therefore, they could only watch the course of events, and learn from the experience of the two companies mentioned whether electrification on the third rail system was the right and profitable one.

St. Pancras Nuisance Action.—The case of Westlake *v.* St. Pancras Borough Council has been before Mr. Justice Neville in the Chancery Division this week. It is a claim to restrain defendants from carrying on their electricity works so as to cause a nuisance by the vibration set up by the engines. Damages are claimed for the past acts of the defendants.

City and Guilds of London Institute.—The diploma of "Associate of the City and Guilds Institute" in Electrical Engineering has been awarded to 23 third-year students of the Central Technical College who have completed the full course of instruction prescribed by the Council. At the head of the list is Mr. E. A. F. Goodfellow, who wins the Siemens Medal and Premium. At the same time 37 students in Civil and Mechanical Engineering, and seven in Chemistry, have been awarded the diploma, while 41 students of the Central Technical College and 82 students of the Technical College, Finsbury, have been awarded certificates.

Neale v. The Electric and Ordnance Accessories Co., Ltd.—In the Court of Appeal on Wednesday, the Master of the Rolls and Lords Justices Moulton and Farwell disposed of this case in which the plaintiff applied for judgment or a new trial of the action which was heard before Mr. Justice Ridley and a special jury at Birmingham. The plaintiff, an infant, suing through his next friend, brought the action against the defendants, who carry on business near Birmingham, to recover damages in respect of personal injuries sustained by him through the alleged negligence of the defendants. The plaintiff was employed by the defendants, and while working at a machine which was fitted with a revolving tool or cutter he had his left hand severed from the arm. Plaintiff alleged that the defendants were guilty of a breach of duty under the Factories Act, 1901, in that the machine being a dangerous one, was not fenced in accordance with the provisions of the statute. Defendants denied negligence, and said that the plaintiff was guilty of contributory negligence. The jury found that the machine was not a dangerous machine, and that the plaintiff was guilty of contributory negligence. Thereupon the judge was asked to assess compensation under the Workmen's Compensation Act, and his Lordship made an award in plaintiff's favour of 3s. 6d. a week. The plaintiff now moved for judgment, or a new trial, on various grounds.

Mr. Acland, K.C., for the respondents, took the preliminary objection that the plaintiff had no right of appeal, he having exercised the option after his claim for damages had failed, of asking the judge to assess compensation under the Workmen's Compensation Act, 1897.

Mr. McCardie, for the plaintiff, pressed their Lordships to hear the appeal. The jury, he said, might well have awarded the lad £700 to £1,000 damages.

The Master of the Rolls, in giving judgment, upholding the preliminary objection, said that in his opinion the plaintiff having exercised his option to have compensation under the Workmen's Compensation Act, and having got an award, which was apparently unimpeachable and properly made, he was estopped from pursuing his remedy in the original action. It had been contended that the fact that the plaintiff was an infant suing through his next friend made a difference—that it must be taken that the option was not exercised for the benefit of the infant, and on that ground ought not to be impeached. His Lordship was unable to see the slightest ground for supposing that the option was not exercised for the benefit of the infant. Unless, and until, steps had been taken to impeach the award under the Workmen's Compensation Act, the Court had no jurisdiction to inquire into the merits of the original action.

Lords Justices Moulton and Farwell concurred.

The appeal was accordingly dismissed, with costs.

Sir Hiram Maxim Electrical and Engineering Co., Ltd., v. National Provincial Electricity Corporation, Ltd.—In the Chancery Division of the High Court on Tuesday, Mr. Justice Buckley had this case before him.

Mr. Mark Romer said he appeared in this case with Mr. Buckmaster, K.C., for the plaintiff company and Arthur George Tracey and Thomas Wood, the two trustees, for the purpose of securing debentures issued by the company, and the summons asked for leave to enforce an award of an arbitrator dated December 3rd, 1903, in the same manner as an order or judgment to the same effect. Shortly stated, an agreement was made between the applicants and the respondents, whereby the Sir Hiram Maxim Co. agreed to construct for the respondents certain machinery, engines, &c., in connection with a supply of electricity for the borough of Bridgwater, the work to be performed for the sum of £13,000. Under the contract the plaintiff company were to be liable for various penalties for delays and so forth. The agreement further provided that the £13,000 should be satisfied as to the first £4,000 in cash and as to the balance in debentures of a company called the Bridgewater and District Electricity Supply and Traction Co., or in cash at the option of the defendant company. The dispute arose as to what was actually due to the contractors from the purchasers, who were the respondents, and the matter was referred to an arbitrator. The arbitrator directed the purchasers to pay to the trustees or their receiver the sum of £1,461 9s. 8d., the balance of the purchase money, and the present application was to enforce that award. The point before the Court was as to how that sum should be paid, having regard to the conditions in the contract as to payment.

His Lordship, after hearing the arguments, held that the proper form of satisfying the award would be for the purchasers (the respondents) to hand over to the applicants £1,100 in debentures, and pay £361 9s. 8d. in cash. This the purchasers had previously offered by letter to the applicants, who would therefore have to pay the costs of the summons.

Damaged Telegraph Insulators. — Considerable damage is continually being done to the Postmaster-General's telegraph system by small boys breaking insulators by catapult shooting. Some of these offenders have damaged large numbers of insulators in the Worksop neighbourhood, and one (though he was not a small boy, being aged 18) was charged. At the Court it was stated that the maximum penalty is two years' hard labour, a fact which, if better known, might deter some of the culprits. In this instance a fine of £2 including costs was imposed, or in default one month's imprisonment.

An Astronomical Observation.—We doubt whether there is any truth in the rumour that the L.C.C. station at Greenwich will be lighted throughout with the B.T.-H. "Meridian" lamp.

Electric Shock Fatality. — On 17th inst. an electrician named Edward George Blackman, an employé of the Metropolitan District Railway, was found dead on the track outside East Ham railway station. He appears to have come in contact with a live conductor.

Correction.—With reference to the notice which appeared on page 92 of our last issue concerning an alleged dissolution of the partnership of Messrs. Green & Trevett, of Cape Town, we are asked by Mr. A. Green, a member of the firm, who is in this country, to state that the report is incorrect.

Scholarships Awarded.—We are informed by the Electrical Standardising, Testing and Training Institution that, as a result of the entrance scholarship examination held at Faraday House on July 18th, 19th and 20th, the following awards have been made:—A Faraday scholarship of 80 guineas a year, tenable for two years, to Arthur L. Ballard, Dunneved College, Launceston; An exhibition of 20 guineas a year, tenable for two years, to N. J. Cook, Allhallows School, Honiton.

Appointments Vacant.—Resident engineer for the Ebbw Vale U.D.C. electricity undertaking; armature winder for Belfast Corporation car works.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Engineers.—Mr. E. F. Evans, Newton Abbot, Devon, has been appointed shift engineer to the Battersea undertaking at a salary of £104 per year. Mr. A. W. Dumbrill, Battersea, has been appointed commercial assistant at a salary of £2 a week and commission. There were 85 applications for the former appointment and 71 for the latter. Mr. S. Clarke was appointed mains assistant, and Mr. H. W. Healy draughtsman, at salaries of £104 and £90 respectively; they have been temporarily engaged for two years past.

Mr. W. H. Taylor, on leaving to take up his appointment as station superintendent at the Walthamstow Electricity Works, was presented by the Ilford Electricity Works' staff with a silver cigarette case. The presentation was made by the chief electrical engineer, Mr. Arthur H. Shaw, on the 20th inst.

Mr. H. Waring's engagement as electrical engineer to the Todmorden Corporation was to terminate yesterday (26th inst.), and all personal communications should be addressed to him at 26, Park Road, Todmorden.

Mr. F. R. Bridger, assistant borough electrical engineer at Southampton, has resigned, he having secured an appointment at Buenos Ayres.

Mr. R. Birkett, at the request of the Southend-on-Sea T.C., has withdrawn his resignation as borough electrical engineer.

Mr. J. A. Lovick, of the Ilford U.D.C. electricity staff, has secured an appointment at the Portsmouth municipal electricity works.

Mr. P. E. Rycroft, of Islington, has been appointed chief engineer-in-charge of the Heston and Isleworth electric light undertaking.

General.—The King has conferred the honour of Knighthood upon Dr. W. H. Perkin, LL.D., F.R.S. The honour comes rather appropriately at the present time, seeing that the Coal-Tar Colour Jubilee was celebrated yesterday.

We are asked to state that Mr. G. H. Corbingham, A.M.I.C.E., A.M.I.E.E., who formerly represented the Reason Co., is now representing Messrs. Venner & Co.

Mr. Colin F. Barrett, of Kirkcaldy, has been selected for the appointment of draughtsman in the Brighton Corporation electricity department.

Mr. J. W. Speight, consulting electrical and tramway engineer, notifies that owing to increase of business in the North he has removed from his London office, and proposes opening offices in Manchester. For the present communications should be sent to him at The Elms, St. Annes-on-the-Sea.

Mr. F. G. Bell has severed his connection with the Sterling Telephone and Electric Co., in order to start in business as a contractor under the name of the Bell Telephone and Electric Co., at Parliament Chambers, Great Smith Street, Westminster.

Herts C.C. has granted £500 to Mr. Urban A. Smith, county surveyor, for services rendered in connection with the light railway at Barnet.

NEW COMPANIES REGISTERED.

Dura Manufacturing Co., Ltd. (89,475).—This company was registered on July 12th, with a capital of £2,000 in £1 shares, to carry on the business of electric lighting, electrical and mechanical engineers, electricians, makers of dynamos, motors and electrical apparatus and fittings, electric and other lamps, &c. The first subscribers (each with one share) are:—W. Berry, 56, Avonmore Road, West Kensington, secretary; H. Godber, 30, Margravine Gardens, West Kensington, W., secretary; J. W. Felstead, 42, Mora Road, Cricklewood, N.W., clerk; J. Madden, 29, Sulgrove Road, W., manager; W. H. Cook, Orchard House, Hampton, cashier; A. Robinson, 101, East Hill, Wandsworth, gentleman; and R. Campbell, 19, Barfield Road, Leytonstone, shorthand writer. No initial public issue. The number of directors is not to be less than two nor more than seven; the subscribers are to appoint the first directors.

Cowper-Coles Copper Corporation, Ltd. (89,493).—This company was registered on July 14th, with a capital of £1,750 in 1s. shares, to acquire from Sherard Cowper-Coles & Co., Ltd., and others the benefit of a certain existing invention relating to the electro-deposition of metals and the patents relating thereto, and to adopt agreements (1) with Sherard Cowper-Coles & Co., Ltd., and (2) with C. K. Milbourne. The first subscribers (each with one share) are:—M. Kelleher, 87, Ferme Park Road, Stroud Green, N., managing clerk; W. T. Pembroke, 66a, Lower Kennington Lane, S.E., estate agent; W. Jacob, 23, Raul Road, Rye Lane, Peckham, S.E., clerk; A. Broughton, 63, St. Agnes Place, Kennington Park, S.E., clerk; J. Coleman, 48, Thornhill Square, N., clerk; J. D. Harrington, 50, Lugard Road, Peckham, S.E., clerk; and G. T. Hedgecock, 1, Honor Oak Park, Forest Hill, S.E., clerk. No initial public issue. The number of directors is not to be less than five or more than nine; the first are V. W. Yorke, C. E. Allan, Sherard O. Cowper-Coles, C. K. Milbourne and R. Steel; qualification, £10; remuneration as fixed by the company. Registered office, 82, Victoria Street, S.W.

Orient Electric Power Syndicate, Ltd. (89,446).—This company was registered on July 10th, with a capital of £5,000 in £1 shares, to carry on in India and elsewhere the business of electric power and light suppliers, electricians, electrical, metallurgical, mechanical and chemical engineers, manufacturers of electrical apparatus, &c., and to adopt an agreement with Killick, Nixon & Co. and John Fleming & Co. The first subscribers (each with one share) are:—F. A. H. Walker, Belmont Avenue, Wickford, Essex, secretary; A. Boughton, 51, Cumberland Street, South Belgravia, S.W., clerk; J. M. T. Horne, 78, Cicada Road, Wandsworth, S.W., electrical engineer; T. Wilson, 10, Eastcheap, E.C., East India merchant and engineer; G. E. Bird, 62, Angell Road, Brixton, S.W., clerk; A. S. Chetwood, 7, St. Helens Place, E.C., solicitor; and F. M. Flower, 29, Great St. Helens, E.C., merchant. No initial public issue. The number of directors is not to be less than three nor more than six; the first are R. W. Hogarth, 80, Parliament Chambers, S.W., T. Wilson; L. R. W. Forrest, 29, Great St. Helens, E.C., Sir Ernest Cable, 6, Cadogan Gardens, S.W., and J. F. Albright, Uplands, Hook Heath, Woking; qualification, 10 shares; remuneration, 25 guineas each per annum (chairman 50 guineas), and 3 guineas each per meeting attended (chairman 5 guineas). Registered office, Parliament Chambers, Great Smith Street, Westminster.

Electrical Industries Development Co., Ltd. (89,461).—This company was registered on July 11th, with a capital of £25,000 in £1 shares (20,000 preference), to carry on in the United Kingdom and elsewhere, the business of suppliers of electricity for light, power and traction, electricians, manufacturers of wires, cables, lines, accumulators, lamps and appliances, &c. The first subscribers (each with one share) are:—F. G. Kerly, 14, Great Winchester Street, E.C., solicitor; H. T. Loring, 17, Thistlethwaite Road, Clapton, N.E., law student; G. H. Allen, Shirley Cottage, Gordon Road, South Woodford, N.E., clerk; W. E. Emery, 6, Queen Elizabeth's Walk, Stoke Newington, N., clerk; F. E. Sankey, 73, Melford Road, Leytonstone, clerk; A. G. Philip, 3, Oakley Gardens, Hornsey, N., clerk; and A. W. Kerly, 14, Great Winchester Street, E.C., solicitor. No initial public issue. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £50; remuneration, £50 each per annum. Registered office, 31, Walbrook, E.C.

Caracas Construction Co., Ltd. (89,576).—This company was registered on July 20th, with a capital of £17,000 in £10 shares, to adopt an agreement (1) with the Caracas Electric Tramways Co., Ltd., (2) and (3) with the United Electric Tramways Co. of Caracas, Ltd., and (4) with J. G. White and Co., Ltd., and to carry on the business of tramway, railway, omnibus, motor and van constructors and proprietors, carriers, electricians, electrical and general engineers, &c. The first subscribers (each with one share) are:—J. S. Austen, Dashwood House, E.C., managing director; J. E. Gunyon, North Cray, Kent, secretary; S. A. Lewis, Homeglade, Park Road, Forest Hill, clerk; F. H. Burr, 9, Trinity Avenue, Westcliffe-on-Sea, secretary; F. W. Turner, 13, Hazlemere Road, Peckham Grove, S.E., clerk; W. J. Eldridge, 166, Friern Road, East Dulwich, clerk; and R. Collins, 25, Davis Road, Acton Vale, W., clerk. No initial public issue. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, one share (solely or jointly); remuneration as fixed by the company.

Cleveland and Durham Electric Power, Ltd. (89,539).—This company was registered on July 18th, with a capital of £1,000,000 in £5 shares (70,000 5 per cent. cumulative preference, with priority as to capital, 70,000 6 per cent. participating ordinary, entitled to a moiety of profits after such 6 per cent., and with priority as to capital over deferred shares, and 60,000 deferred), to acquire over 99 per cent. of the shares in the Cleveland and Durham County Electric Power Co. (Parliamentary Co.) and the majority of the shares in the Northern Counties Electricity Supply Co., Ltd., to develop the supply of electric power in Cleveland and the County of Durham, and in certain districts in Northumberland, on lines similar to those adopted by the Newcastle-upon-Tyne Electric Supply Co., Ltd., and the County of Durham Electric Power Supply Co. on Tyneside, and to carry on the business of generators, transmitters, distributors or suppliers of electrical or other energy, &c. The first subscribers (each with one share) are:—J. H. Armstrong, St. Nicholas Chambers, Newcastle-on-Tyne, chartered accountant; M. L. Bell, Rounton Grange, Northallerton, Yorks., ironmaster; C. Emmott, Thorpe Hall, Darlington, gentleman; J. Falconer, 52, Castle Street, Edinburgh; the Hon. Robert James, St. Nicholas, Richmond, Yorks., gentleman; Sir John D. Milburn, Bart., Acklington, Northumberland; and A. G. Gridley, Moorfields, Fenham, Newcastle-on-Tyne, electrical engineer. Minimum cash subscription as fixed by articles, seven shares; as stated in the prospectus £300,000. The number of directors is not to be less than three or more than nine; the first are J. H. Armstrong, M. L. Bell, C. Emmott, J. Falconer, the Hon. Robert James and Sir John D. Milburn, Bart.; qualification, £500; remuneration, £600 per annum divisible; registered office, Royal Exchange Buildings, Newcastle-on-Tyne.

London Sherardising Co., Ltd. (89,533).—This company was registered on July 17th, with a capital of £20,000 in £1 shares, to acquire an exclusive licence to use and exercise certain processes for depositing metals on metals known as the "Sherardising and analogous processes," to adopt agreements (1) with P. Dawson and (2) with the Sherardising Syndicate, Ltd., and to carry on the business of galvanisers, zinc workers, steel and ironmasters, founders, tinplate workers, smelters, manufacturers and blenders of alloys, &c. The first subscribers (each with one share) are:—P. Dawson, 6, Great Winchester Street, E.C., secretary; W. J. Newall, 6, Mortlake Road, Kew, mining engineer; J. Burn-Murdoch, 61, Nightingale Road, Harlesden, N.W., engineer; C. E. Rouse, Suncroft, Pollard Road, Mitcham, Surrey, civil engineer; W. W. Underwood, 6, Great Winchester Street, E.C., gentleman; R. J. P. Dawson, 31, Priory Road, Bedford Park, W., gentleman; and C. E. Wilkey, 6, Great Winchester Street, E.C., secretary. No initial public issue; the number of directors is not to be less than three or more than five; subject to second agreement the subscribers are to appoint the first directors; qualification (except first directors), £100; remuneration, £50 each per annum and 10 per cent. of the profits remaining after 10 per cent. dividend is paid, divisible.

Nottingham Gas and Electric Fittings Co., Ltd. (89,587).—This company was registered on July 20th, with a capital of £1,000 in £1 shares, to adopt an agreement with W. W. Favell and J. E. Watts for the acquisition of the businesses lately carried on in Nottingham by the said W. W. Favell as "S. Haynes & Co.," and the "Nottingham Gas and Electrical Stores," and by the said J. E. Watts as "Watts' Incandescent Depôt." The first subscribers (each with one share) are:—W. W. Favell, 28, Rood Lane, E.C.; A. E. Favell, 392, Lenton Boulevard, Nottingham, merchant; T. J. Clements, Medeswell, Stanley Road, Woodford, gentleman; J. E. Watts, 48, Goose Gate, Nottingham, incandescent fittings merchant; A. Smith, 107, Exchange Road, West Bridgford, Nottingham, electrical engineer; J. B. Templeman, 39, Church Drive, Carrington, Nottingham, cashier and book-keeper; and A. Hatchell, 231, Woodborough Road, Nottingham, farmer, &c. No initial public issue. Registered without articles of association. The first are W. W. Favell, A. E. Favell and J. E. Watts. Registered office, 17, Dilks Yard, Long Row West, Nottingham.

Holland House Electrical Co., Ltd. (6,246).—This company was registered in Edinburgh on July 13th, with a capital of £6,000 in £3 shares, to acquire the business of the Holland House Electrical Manufacturing Co., Ltd., and to carry on the business of manufacturers of and dealers in electricity, gas and oil, cast and wrought metal work, machinery, &c. The first subscribers (each with one share) are:—J. Fleming, 136, Glebe Street, Glasgow, chartered accountant; R. Paterson, 105, West George Street, Glasgow, chartered accountant; H. Watson, 9, Holland Place, Glasgow, electrician; J. McFarlane, 9, Holland Place, Glasgow, electrician; R. H. Robertson, 9, Holland Place, Glasgow, clerk; R. G. Paterson, 105, West George Street, Glasgow, clerk; and G. G. Paton, 241, St. Vincent Street, Glasgow, solicitor. The present directors of the old company are the first directors of this company; qualification, £30. Registered office: 9, Holland Place, Glasgow.

Victor Arc Lamp Co., Ltd. (89,571).—This company was registered on July 19th, with a capital of £3,000 in £1 shares, to acquire the patents granted to V. W. Riley and H. W. Rowing in an invention for an improvement in connection with electric arc lamps, and to carry on the business of arc lamp manufacturers, electrical and general engineers, &c. The first subscribers (each with one share) are:—R. P. Sims, Le Chateau, Sewardstone, Bury, Essex, engineer; E. J. Stevenson, East Dene, Buckleigh Road, Streatham, S.W., engineer; A. C. G. Smith, 319, Trinity Road, Wandsworth, S.W., gentleman; H. Noakes, 16 and 17, Devonshire Square, E.C., engineer; V. W. Riley, 7, St. George Street, E., engineer; H. W. Rowing, 7, St. George Street, E., engineer; and F. Stevenson, 15, Buckleigh Road, Streatham, S.W., engineer. No initial public issue. The number of directors is not to be less than two or more than six; the first are R. P. Sims, E. J. Stevenson, A. C. G. Smith, H. Noakes, V. W. Riley and H. W. Rowing. Registered office, Terminus Chambers, 6, Holborn Viaduct, E.C.

CITY NOTES.

Central London Railway Co.

THE report for the last half-year states that the amount expended on capital account has been £14,270. Receipts from all sources of revenue amount to £180,225, a decrease of £5,650, and working expenses to £94,048, a decrease of £1,626, leaving a balance of £86,177 to be carried to net revenue account. The passengers carried numbered 22,336,489, a decrease of 700,946. The adoption by the other underground railways of electric traction, and the introduction of motor-omnibuses on the Oxford Street route, have somewhat affected the company's traffic, but the diminution in receipts is comparatively small. The average receipts per passenger for the half-year have been 1·86d., the same as in the half-ended June 30th, 1805. After providing for interest on debenture stock and other payments, the net revenue account shows a balance of £92,257, including £25,393 brought forward from last half-year. The directors recommend a dividend on the undivided ordinary stock at the rate of 4 per cent. per annum, and on the preferred ordinary stock at the rate of 4 per cent. per annum. Reserving £10,884, proportion of dividend applicable to the deferred stock, which is not payable until the result of the year's working has been ascertained, there remains a balance of £32,257 to be carried forward. The quinquennial re-assessment has increased the valuation for rating purposes, so that the amount paid by the company in rates and taxes during the half-year amounted to no less than 18½ per cent. of the net revenue.

Direct United States Cable Co., Ltd.

THE fifty-eighth ordinary general meeting of the above company was held on Tuesday at Winchester House, E.C., under the chairmanship of Mr. E. M. Underdown, K.C.

The CHAIRMAN, in moving the adoption of the report, said he thought they would agree with him that the excellent expectations which they had formed of the position and working of the company had abundantly established, and that they could now congratulate themselves upon three or four topics which were extremely satisfactory. In the first place, business had been very active as between this country and the United States, which was generally a pretty good index that business was good throughout the world. They were in most excellent relations with their allies and with the organisation in the United States. Their cables were in perfect order, which was a very important matter, and they could all admit that their financial position was a very strong one, arising as it did from the prudent use of their resources for a good many years. The half-year's revenue after deducting out-payments, amounted to £56,265, and the working and other expenses, including income-tax, but exclusive of the cost of cable maintenance, absorbed £23,924, leaving a balance of £32,341 as net profit which, with the £5,848 brought forward from the previous half-year, made a total of £38,189. This had been appropriated as follows:—An interim dividend of 4s. per share was paid on March 3rd, and took £12,142; they proposed a final dividend of 4s. per share and a bonus of 2s. 6d. per share up to June 30th, which would require £19,731; and they proposed to carry forward £6,316. He would like to mention that their carry forward was not limited to that, because, although they stated that when they arrived at the very satisfactory figure of £500,000 as reserve fund they should cease to add to that fund in the ordinary way, yet, in point of fact, they had £4,000 over the £500,000, and the result was that really they had a carry forward of something like £11,000, which he thought they would agree was very ample provision in that respect. For the first time for many years they were making no transfer from the revenue to reserve fund, which was in accordance with what he said the last time he addressed them. He told them that having reached £500,000, they could with prudence and justice give the shareholders the advantage of the whole of the net profit, and that had been carried out by giving the shareholders a bonus of 2s. 6d. per share. The revenue had shown considerable improvement during the half-year, as compared with the corresponding period of 1905—the increase amounting to £6,795, or nearly 14 per cent., due to the expansion of Atlantic

cable business generally. During the present half-year from July 1st, they had shown an increase of 11 per cent. over the corresponding period of last year. The working expenses at London, and at the stations on the whole, having regard to the increased business of the company, compared not unfavourably with those in the last account. The other items in the account were of a more or less fixed character, but, with regard to the item of income-tax, which had been for some time entered in the accounts as subject to adjustment, they would be glad to know that the company's appeal to the Government had been settled in what they considered a very satisfactory manner. They had secured an appreciable reduction in their assessments. The result of this would appear in their future accounts. Their reserve fund had been credited with interest, &c., and after £7,143 had been deducted for cost of maintenance, it stood in the accounts at £504,184. A summary of the results of the whole year's working showed the receipts to be £112,618, and after the deduction of £47,223 for expenses, there was a balance of £65,395. They had paid in dividends £51,605, placed to reserve £10,000, and had an increased balance in hand, as compared with 1905, of £3,791.

Sir James Pender seconded the motion, and the report was adopted.

Electric Supply Corporation, Ltd.

The fourth annual general meeting of the above company was held at Salisbury House on Wednesday, Mr. C. F. Tufnell (chairman) presiding.

The Chairman, in moving the adoption of the report, said that no doubt it would be considered a satisfactory one, recording as it did steady progress in the number of consumers and lights installed in every town in which the company's operations had commenced. It must not be forgotten that with the sole exception of the Chelmsford undertaking, the business of electricity supply had only recently commenced; indeed, in the cases of St. Andrews and Exmouth, the permanent supply was only started during the past year. At Hitchin and Dumbarton, a temporary supply only had been made, the permanent machinery not being yet in a sufficiently advanced state to take the place of that temporarily installed. In these circumstances, it could not be expected that the accounts would show much profit, particularly as it invariably required some years before an electric supply undertaking could advance to the profit-earning stage. Reference was made last year to the case of the Chelmsford undertaking. This and the Totnes supply were worked as separate companies, and although the net result of the Chelmsford business amounted to nearly £4,000, the accounts of the parent company only benefited to the extent of some £2,000, the actual amount of the dividend received. It had been considered desirable that the results of all the undertakings owned or controlled by the company should be pooled, and the board proposed that in a private Bill to be submitted to Parliament next year. Provision should be made for transferring all the undertakings, including those of Chelmsford and Totnes to the company. The business in each of the towns would have to be worked separately under the respective provisional orders, but the whole of the net results, whether profit or loss, would be brought into the accounts of the company, a course which would make for simplicity and would place the business on a proper and satisfactory footing. The passing of the Bill was practically the only way of effecting the transfers to their company, and when this was accomplished the company would be properly established with full statutory powers in each district, whereas at the present moment some of these powers were in the name of Messrs. Crompton & Co. and some in the names of the local authorities, a state of affairs which should be terminated as soon as possible. The course proposed had been adopted after consultation with the Board of Trade. It was mentioned last year that an arrangement had been made with a responsible company for guaranteeing the earnings of the company during what might be called the "lean" years—that was during the period estimated at four years, in which the business was growing into a profit-earning condition, and after which they would hope to be able to run alone, and, after 6 per cent. had been paid to their shareholders, to gradually return the guarantee money received. Under this guarantee they were now receiving the first instalment, by means of which they were able to declare an interim dividend at the rate of 5 per cent. on the paid-up share capital for the six months ending June 30th. The sanction of the shareholders was given last year to the promotion of a Bill in Parliament for authority to construct an electric tramway from Clydebank to Dumbarton, and from Dumbarton to Balloch on the shores of Loch Lomond. This was part of the original scheme, and it was believed would prove a valuable addition to the company's business. The preamble of the Bill had been approved, and it was hoped the Bill would be passed in due course. As regarded the progress since the date of the closing of the accounts, they would be interested to learn that the applications from their new consumers continued satisfactory. Dumbarton and Hitchin were now temporarily installed, and current was being sold in each town. It was fully anticipated that the permanent plant would be ready by September next, in time for the heavy winter load. The Falmouth installation would also soon be in a revenue-earning position, and the tramways in Dumbarton were now approaching completion, and the cars should commence running at the end of the year. The operations of the company were assuming large dimensions. The capital expenditure to December 31st last amounted to £184,289, and was still rapidly growing. The increase during the year 1905 was more than £61,000. The work of controlling such a business with its multiplicity of detail was an arduous one both for the directors and staff, and he would like to testify to the zeal displayed by Mr. Scott Moncrieff, the general manager, and Mr. F. R. Reeves, the secretary, in the labours devolving upon them. The principle of combining a number of businesses under one management was undoubtedly a sound one. The costs of management were thereby distributed over a large area, and they looked forward with confidence to a successful future.

Col. Wood seconded the motion, and the report was adopted without discussion.

Thomas Parker, Ltd.

The directors in submitting the accounts for the year ending April 30th, regret having to report that the competition and continued low prices, combined with the large increases in the prices of raw material, have adversely affected the results of the year's working. After deducting general charges, maintenance and interest on debentures, there remains an adverse balance, which it is proposed to meet by transferring £5,000 from the reserve fund, carrying forward £289 to next year's accounts. The orders for the last six months of the year show an improvement which the directors are glad to report still continues, and the total orders received for the year ending April, 1906, are in excess of those for the previous 12 months. The number of men employed fell during the year to about half that of three years ago, but all departments have been kept on full time, and in several shops overtime has had to be resorted to, and the number of hands is now increasing again. Before the beginning of the year the management were led to the opinion that a radical change in the type and design of continuous-current machinery was imminent, and it was decided to break away from the then universal practice and prepare for the new development. Their patent "C" type dynamos and motors were put on the market, and auxiliary poles were fitted on all machines. The first "C" type machine was invoiced in June last year, and the orders and output for this type had rapidly grown, until this was now their standard design. The auxiliary pole was now being taken up by most of their competitors, both at home and abroad, which justified the foresight which led them to adopt it for the modern ordinary dynamo. These changes had greatly reduced the cost of production, as even at the present low prices reasonable profits were secured on standard machines, but it had been impossible to make these drastic changes to patterns and designs without a considerable reduction in the output of the shops, which further accounted for the deficiency. As there was every indication that designs were now becoming stable again, the output of the "C" type should continue to increase rapidly. The directors had lost no opportunity of enlarging the scope of the business, and had acquired the rights for certain new patents which they believed would be the means of increasing the output of the works largely in the near future.

City and South London Railway Co.

The directors' report for the half-year ending June 30th, 1906, to be submitted at the meeting next Tuesday, states that the receipts from all sources amounted to £77,395, and the cost of working was £34,781, leaving a profit of £42,614. Inclusive of the balance brought forward from December 31st last, the net revenue account shows an aggregate total of £45,712. After making provision for the debenture stock interest, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £32,987. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896 and 1901, and that a dividend at the rate of 2¼ per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving a balance of £1,871 to be carried forward.

The following table shows the number of passengers, exclusive of season ticket holders, carried during the last three years, and dividends paid in each half-year:—

Half-year.	Number of passengers (exclusive of season ticket holders).	Receipts (including season tickets).	Dividend per cent. per annum on ordinary stock.
December 31st, 1903	8,711,062	£72,286 3 6	2
June 30th, 1904	9,226,987	76,387 14 1	2¼
December 31st, 1904	8,401,846	70,705 10 11	1¾
June 30th, 1905	8,662,588	71,802 7 8	2
December 31st, 1905	8,607,486	70,103 14 4	1¾
June 30th, 1906..	9,045,120	72,454 3 11	2¼
Total since the opening of the line..	161,024,308	£1,290,976 18 11	

The directors record an increase in the receipts enabling them to recommend a dividend at the rate of 2¼ per cent. per annum, against 2 per cent. for the corresponding period last year. They are satisfied with the progress made by the contractors on the extension to Euston. Notwithstanding the difficulties encountered, the tunnelling is rapidly nearing completion. The arrangements for providing the electric equipment of the extension, and the new rolling stock, are in progress. The short subway communication between the Elephant and Castle Station platforms and those of the Baker Street and Waterloo Railway is completed, and satisfactory arrangements for through bookings between the two companies have been arrived at. The opening of this valuable

connection may be expected to take place in August. Passengers will be thereby enabled to travel direct from Clapham Common and their other South London stations to Waterloo station, Embankment (for the District Railway), Trafalgar Square (for the South Eastern Terminus, Charing Cross), Piccadilly Circus, Oxford Circus, Regent's Park (for Zoological Gardens), and Baker Street (for Lord's Cricket Ground) and the St. John's Wood line of the Metropolitan Railway. From the stations at Angel, City Road, Old Street, Moorgate Street, the Bank, and London Bridge, the quickest railway route to many of those places in the West End will be by this company's line, and that of the Baker Street and Waterloo Co. In order to cope with the increased traffic which it is anticipated will follow the opening of the Euston extension and the Baker Street and Waterloo line, and to provide accommodation for the new rolling stock, a contract has been entered into for the construction of additional sidings at Stockwell, and the work is proceeding. During the past half-year the balance of the 1901 5 per cent. preference stock has been placed, and provision for the capital necessary for the completion of the Euston extension and the Stockwell sidings is receiving the careful consideration of the board. It is not contemplated that any portion of these new issues shall become a charge against revenue until after the extension is opened.

Messrs. Baker, Mott and Hay report that very satisfactory progress has now been made with the works in connection with the Euston extension. The whole of the tunnelling, including that for the stations and cross-over roads, is complete, with the exception of 330 yds. of main line tunnel between Euston and St. Pancras, and St. Pancras and Weston Street. This will be finished early in August.

Electric Construction Co., Ltd.

The annual general meeting was held on Thursday last week at Winchester House, Mr. J. W. Barclay presiding.

In moving the adoption of the report, the Chairman said that the accounts showed £6,045 of profits available for dividend, after maintaining works and plant, and providing £5,000 for depreciation, and the directors recommended the payment of a dividend on the preference shares, which would absorb £4,395, and a balance of £1,651 would be carried forward. This disappointing outcome of the year's business was due to causes beyond the control of either the directors or the management. Last year he told them that the competition among manufacturers of electrical machinery had been intense, and still continued, but that there were more orders about, which he hoped would lead to better prices and profits. Their business had increased, but unfortunately there had been no increase of prices or profits, and although they had done their best towards economy in production combined with efficiency, the margin of profit secured was not sufficient to pay a dividend on the ordinary shares. They refused to reduce prices until forced to do so by emptying workshops, and they had endeavoured to advance prices as called for by the higher cost of raw materials, but their efforts had been in vain. They were not alone in this unfortunate position, for a survey of the annual accounts of others engaged in the same business disclosed an absence of profits which must be no less disappointing to them than it had been in their own case. This discouraging result did not arise from any falling off in the demand for electrical plant or from foreign competition, but was caused solely by the excessive expansion in this country of factories for the manufacture of electrical plant. Some three or four years ago great preparations were made for increasing the supply of electrical machinery, for which it was foreseen a great demand would arise, and although the expectation had been to some extent justified, the demand had not come in sufficient volume to provide employment for all the factories. The struggle among the new or extended works to fill their workshops had been so keen that prices for electric installations had been reduced to the point of no profits, and this they would fully realise when he informed them that the price of electrical machinery had in the last three years been reduced by more than one-third, and that in spite of a considerable advance in the price of raw materials during the last 12 months. The cause of the unprofitable result of their business was, therefore, clear enough, and no doubt they would like to know how long the present state of matters was to go on. He wished he could tell them. The demand for electrical plant would, no doubt, grow, but he could not entertain a hope of better profits until competition was reduced. The plain fact was, there were too many of them for the work to be done, and they could easily see that the future was a question of the survival of the fittest. In this point of view he thought they were as favourably equipped for a struggle as any of their competitors, and their directors and officers must, undiscouraged, continue their efforts towards greater economy in production and increased efficiency, so as to maintain the high position the company had hitherto held in the manufacture of electrical plant. As to the financial position, last year they had on the debit side of the balance-sheet a loan of £7,500. That was repaid, and this year they had no loan. They would have observed a falling off in the return from shares in other companies. This was due to a reduction in the dividend of the Madras Tramways Co., caused by a falling off of the receipts in consequence of a bad monsoon last year and an outbreak of plague in the city of Madras. The interest on the outlay in the construction of the extensions had been charged to revenue account, although as yet there had been practically no return for this expenditure. He was, however, pleased to inform them that since the beginning of June, when a part of the extensions was opened for traffic, the increased receipts were very encouraging, and gave good ground for anticipating a satisfactory return from this property, not only ultimately, but in the not distant future. The Electrical Power Storage Company, Limited, continued to do very well, for, notwithstanding the depression and severe competition that had prevailed during the year, its previous dividend of 6 per cent. was maintained. As he mentioned last year, they had intended to offer a part of their large holding in the company to shareholders, not because they were dissatisfied with the return, but because they could do with part of the money in their own immediate business; but the feeling in the financial world against everything electric had been so strong, without, as he thought, adequate justification, that they did not think it expedient to offer the shares. He believed a reaction was not far distant, for nothing that had happened seemed to justify the recent distrust, and, when confidence did return, they intended to offer a part of their large holding in that company at a price which they believed would yield a good and permanent return to investors.

The motion was seconded by Mr. J. Irving Courtenay.

Mr. Rickman, a shareholder, remarked that for so small a profit the directors' fees seemed rather high. He did not wish to say anything against the present board, but he thought that there was a need for fresh blood to be introduced.

Mr. Hancock, another shareholder, in criticising the board, remarked that he had seen one of the directors' names on the prospectus of the Electrobus Co., and he considered it was most unfortunate. He, too, advocated the addition of younger men to the board, and thought that in that way they might be able to meet the competition of other companies.

The Chairman, replying to these and other remarks, said that for his part he would be very glad to give up his place on the board in favour of someone else. It would relieve him of much worry and responsibility. The Americans had come across and were going to do wonderful things, but so far they had not paid a dividend. If the shareholders could find a man who would be willing to come on to the board and work for a year or two for nothing, he was sure that his co-directors would welcome him. As to the Electrobus Co., it had nothing whatever to do with that company.

The report was adopted, and the retiring directors re-elected.

Edmundson's Electricity Corporation, Ltd.

The ninth ordinary general meeting of the shareholders of this company was held on Monday at the Westminster Palace Hotel, Mr. Henry Wolfenden, chairman and managing director, in the chair.

In proposing the adoption of the report, the Chairman explained that the reason he was in the chair was because in October last Mr. F. E. Gripper, feeling the strain of the chairmanship too great, tendered his resignation. The resignation was accepted with regret, and he (Mr. Wolfenden) was elected to the position. It was unfortunate that on the occasion of his first appearance as chairman it fell to his lot to propose a reduced dividend on the ordinary shares, but he did not think that any alarm need be felt at that reduction. Of course it was unpleasant, but the reason for it at the present time was obvious. The net trading profit for the year was £27,709, as against £38,618 in the preceding year—a falling off of £10,902, and that contrasted with £12,000, the sum by which the dividend was reduced. The reason for the decrease in the trading profit was that less capital had been spent during the year on installation or promotion account; the reduction of expenditure under that head being £150,517 as compared with the preceding year. A further diminution of expenditure under that head would be shown this year, and thereby their financial position would be strengthened. On the other hand, interest and dividends receivable from their investments had increased by £2,078 only. The shareholders might naturally ask how it came about that with increased investments of £132,509, and in addition with the transfer from the non-dividend earning to the dividend earning stage of about £39,000 of their investments, so small an increase in dividends was shown. There were various explanations for that. In the first place, whatever might be the state of trade now, it was not brilliant during the early part of the financial year, with the result that users of current practised every economy, and that was continued more or less throughout the year. He thought that they now saw evidences of an improvement in the condition of affairs. Another explanation was that acting upon optimistic views their expert advisers might have recommended an outlay in the past somewhat in excess of what had so far proved necessary to meet the requirements of the case, but they hoped that that would largely correct itself in course of time. Whilst their stations which were at work generally showed progressive results for the year, one of them—Guernsey—had retrograded to the extent of about £500 of income, notwithstanding that about £2,000 or £3,000 additional capital had been expended. Hamilton also, which was one of the local authority's undertakings, had retrograded by some £700 compared with the previous year. On the other hand, £25,000 had been invested in the Inverness undertaking, and was included in the dividend-earning class this year because it formed part of the North of Scotland capital which was already earning a dividend, although, as a matter of fact, Inverness scarcely contributed any profit to the parent undertaking owing to the fact that it only commenced to generate in May, 1905. In like manner the Scarborough investment showed an increase of nearly £12,000, and, unfortunately, that only produced an increase in income of £198. Of their total investments of £1,413,101, £398,474 had not yet reached a dividend-earning stage, which was made up mainly of their holdings in the following companies:—Alderley and Wilmslow Electric Supply Co., Ltd.; Isle of Wight Electric Light and Power

Co., Ltd.; Lancashire Power Construction Co., Ltd.; Ramsgate and District Electric Supply Co., Ltd., and the Urban Electric Supply Co., Ltd. It was important to remember that every 1 per cent. which the total amount might yield in the future was equivalent to close upon 1 per cent. of their ordinary share capital. They had considerable hopes for the future of those companies. The Lancashire Power Co. took power to supply consumers with current, but owing to the limitations imposed by the original Act practical difficulties were placed in the way of their approaching consumers direct. Those difficulties had now been overcome, as the Power Co. had promoted a Bill to that end this session, which Bill was now only awaiting the Royal assent. The local authorities had expressed their willingness and even their anxiety to make arrangements with the Power Co., and they were taking active steps to push the business. It must, however, be borne in mind that a power company required a certain period of time to acquire its customers. As to Ramsgate, that company only commenced supplying customers in October, 1905, so that the year did not derive any profit from that station, but at the end of June, 1906, they had the equivalent of 8,951 8-candle-power lamps installed, which he thought they would agree was satisfactory progress. The Urban Co. was showing a distinct advance, the units sold during the half year being about 30 per cent. in excess of those for the corresponding half of 1905. The whole of the benefit arising from that increase would be felt by their company, as by agreement they guaranteed the dividends of that company up to the end of 1910, and under that agreement so far they had had to make up a deficit. The Alderley and Isle of Wight companies were making good progress, and ought before long to become dividend payers on their ordinary shares. The total increase in their investments for the year was £132,509, being the difference between £1,413,101 and £1,252,789, plus £27,803, the amount of their investments at the end of March, 1905, in local authorities' undertakings. The principal increases in capital account were Alderley, where they had spent about £19,000; and the Lancashire Power, the North of Scotland, on account of Inverness, and Ramsgate, were all up. The Scarborough tramways was also up on capital account by about £10,000, but so far they were receiving a very inadequate return on that investment, which he was sorry to say had proved a very disappointing one. As to the immediate future the board felt that the concern needed rest, and they intended to confine themselves to developing their existing undertakings and bringing them to a remunerative stage, limiting their capital expenditure as far as possible, consistent with the proper carrying on of the business. He could not give any binding pledge for the future, but he could assure them that the directors of Edmundson's Co. had no intention of raising any additional capital during the current financial year, nor did he see any reason why they should do so in the year following. He did not wish them to take that statement as implying that he saw any further necessity for capital expenditure in the future. Of course it was a matter for regret that the dividend on the ordinary shares should have been reduced, but the board felt that the best interests of the company were being served by the step they had taken. They were now in a state of transition, and their desire was to maintain the company in a sound and strong position. He was not going to prophecy but if, as he hoped, 4 per cent. was their low water mark, the shareholders would not have been called upon to sustain any great hardship.

Mr. W. R. Davies seconded the motion.

A long discussion ensued, in which many shareholders took part.

Mr. Barber said that a year ago they had a very glowing report, and the board held out no expectation that the trading profits were going to subside nearly out of sight. He did not think that the shareholders had been sufficiently taken into the confidence of the directors, and said he could not understand why, when the interim dividend of 2½ per cent. was paid, there should have been such large selling of shares. It looked as if somebody had got information which was withheld from the ordinary shareholders.

Mr. Fuller said he thought they were exceedingly indebted to the Chairman for what he had done for the company, and it seemed to him that they wanted new blood on the board to assist him in his work. As to the Lancashire Power Co., that was known in the North as "Edmundson's folly," and he expressed grave doubts as to its future. No doubt they would get plenty of customers—everybody could do that if they gave goods away. The Leeds Corporation was charging 1½d. per unit, whilst the Power Co. was going to be satisfied with something less than half that price. He suggested that as the directors retired in rotation they should not be re-elected, but replaced by new men.

The Chairman, in reply, said that as to the Lancashire Power scheme he had faith in that concern. The scheme would not ripen in a year, but he believed that eventually there was the making of a very fine and profitable business there. As to the shares falling in price, all he could say was that not a single director had reduced his holding, and, as a matter of fact, there had been less transfer of shares last year than usual. Their position with the Urban Co. was that they guaranteed the interest on the whole of the capital up to 1910 and they took the whole of the profits. So far they had invested £79,000 in the Lancashire Power Co., and a further sum had been invested during the current financial year, and he thought that a further amount would be necessary to bring it to a state of completion and prosperity. He should think that before they had finished their liability would probably be not less than £100,000.

The report was then adopted.

On a resolution being proposed for the re-election of Mr. Walter B. Hopkins as a director, Mr. Barber moved that the largest shareholder should be elected in his place.

The Chairman ruled this out of order, as no notice had been given, and Mr. Hopkins's re-election was agreed to.

National Telephone Co., Ltd.

The twenty-eighth annual general meeting of the company was held on Thursday of last week, at Hamilton House, Victoria Embankment, E.C., Mr. George Franklin in the chair.

The Chairman, in proposing the adoption of the report, said he must claim their indulgence by reason of the fact that he occupied the chair for the first time, and his difficulties were none the less because he was following so able and experienced a man as Sir Henry Fowler, whose wisdom and sound advice were always at the service of the company. As those present knew, the report that day was an interim one; for the first five months of the year, they had audited accounts, but for the month of June, the profit was an estimated one. On the second page of the report they had in a nutshell the whole story which the directors could tell them. They had there the income, what it had cost to earn it, and what was left. The income for the half-year had gone from £1,086,381 to £1,195,685, being an increase of £109,304, as compared with the corresponding period last year. That represented an income on 308,623 stations, of which 24,210 had been added during the half-year. Post Office royalties amounted to £113,365, making a total of £2,130,000 paid to the Post Office, for which they had received absolutely no service at all. The net income was £1,082,320, as against £985,791; an increase of £96,529. They had to deduct working expenses amounting to £696,193, or 64·32 per cent. of the net income, an increase of £68,878. Shareholders might ask how it was that the working expenses were increasing in a greater ratio than the income did. The answer was that during the past two years the board had had to adopt cheaper rates of tariff, both in London and in provincial towns—he meant the message rates—and the result had been to bring down somewhat the revenue per line, although the percentage remained the same. Under expenses they had an increase of £11,483 for rent of premises, rates and taxes. The increase had been due to two things, first, the increase in local rates, and secondly, insurance. In insurance, owing to change of circumstances, they had had to pay £5,000 more for premiums. During the last few years the board had adopted the policy of taking a portion of the fire risks themselves, and already they had built up an insurance fund of £25,000, the property of the shareholders, which was at their disposal. The maintenance and renewal of wires expenses had increased £22,416, that item now standing at £228,052. That was due to the policy of the board in renewing from time to time all wastage of plant out of the revenue, and he hoped the policy would commend itself to the shareholders. The net result of the half-year's working was an increased profit of £27,650, and out of that there was absorbed by debenture and other interests a sum of £5,359. Preference and other dividends would absorb £13,708. They had transferred £10,000 to the reserve fund, making a total of £120,000 for the half-year, and a balance of £10,858 had been carried forward. Turning to the statement of accounts, the amount previously expended on construction of exchanges and private stations was £11,287,194, and during the half-year further expenditure amounting to £608,407 had been spent on constructing 24,210 stations. The total amount under that head was £11,895,602, which, divided over the total number of stations, worked out at a cost per station of £30 15s. 4d. Some years ago the Postmaster-General adopted the policy of granting licences to municipalities, and amongst them one was granted to the Glasgow Corporation. During the month of June, 12,821 stations were working on the municipal system, and £362,000 was spent by the Glasgow Corporation in constructing those 12,800 stations, which worked out at a cost per station of £28 5s. Thus whilst the National Co.'s cost for London and provinces amounted to £30 15s. 4d., there was the Glasgow Corporation starting with many advantages which they did not have, with an expenditure of £28 5s. If they reduced the sum set aside out of the profits for reserve, the cost per station would work out at £25, as compared with the Corporation's £28. They heard with pleasure that the Post Office proposed to purchase the Glasgow undertaking, as it would put an end to the senseless competition, and because it demonstrated the opinion that the Government gave proper treatment to their licensees, as it was absolutely beyond all reason to suppose this Government would mete out different treatment to different licensees. He would like to refer to their reserve fund. They would add as he had mentioned £120,000 that year, and it would then amount to £2,065,943. The board regarded the reserve fund as an insurance against any ultimate shrinkage in the business of the company. Previously to last year they were always uncertain, owing to their limited tenure—namely, December 31st, 1911—but although that uncertainty had been removed by the agreement confirmed by the House of Commons, there still remained considerable uncertainty as to the price which would be paid. The amount might have to be determined by arbitration, and in view of that contingency, they felt it necessary to strengthen their reserve fund so as to ensure the repayment of the company's capital. The new expenditure which would be incurred during the next 5½ years would be reproductive, and their future policy would be only to spend money on a class which would be sufficient to earn interest and all proper charges. There were two figures that his predecessors always gave them, and he supposed they would expect him to do the same. The number of shareholders was 11,107, with an average holding of £537, and the debenture holders numbered 4,392, with an average of £824. The growth of the staff was always an interesting figure, and the number now stood at 16,709, as against 14,647 last half-year.

Mr. Samuel H. Sands seconded the motion.

Mr. Lea Smith congratulated the board on the past year's working, and mentioned that he thoroughly approved of the policy of

the board in building up a large reserve fund. The remarks of the chairman as to not taking up any new business unless it was reproductive, he (the speaker) thought, would be considered very satisfactory by the shareholders.

Mr. Jackson criticised the action of the board in building up such a large reserve fund, and moved "that the report be not adopted," suggesting that possibly the board would see their way to paying a higher dividend out of the reserve fund.

Several other shareholders deprecated the building up of so large a reserve fund, but none of them seconded Mr. Jackson's motion.

The Chairman, in reply, emphasised the need of building up a reserve fund so that, in case of their business shrinking, they would, when the time of their tenure ceased, be able to pay back the company's capital.

General Electric Co., Ltd.

Mr. G. Byng presided at the annual meeting held at 71, Queen Victoria Street, E.C., last Friday. In moving the adoption of the report, he said that the accounts did not differ materially from those submitted last year, but, unfortunately, the difference, such as it was, consisted in a reduction of the profits earned by about £3,000. They had written off plant and building account a sum equal to the depreciation of last year; they proposed that 5 per cent. should be paid upon the ordinary shares, but the amount carried to reserve suffered to the extent of £3,600. The reserve account now stood at the respectable figure of £108,000, or more than 50 per cent. of the amount of their debentures. Their income from investment was less, and the capital account of investments was reduced by about £18,000. They had been able to sell at an advantage a block of debentures in an undertaking which they had started, and this sale relieved them from finding capital for this undertaking. He believed the aggregate of their investments was worth a larger amount than the amount in the books. They had added £30,000 to the property account during the year. They must always be prepared to spend largely on extension of factories; that was the only means of keeping up to date. They had extended both Witton and Salford works. They had added a large wing to their engineering shops, and had almost doubled their testing and power houses. At Salford they had built new instrument works, and transferred the whole of their wood-working shops to new premises. All these additional works had been equipped with new machinery, and he trusted that they would help the output and profits of the coming year. Their profits had suffered very largely on account of the rise in raw materials, iron, copper, lead, tin spelter, platinum, india-rubber, timber, manganese, mica—almost every raw material they used had gone up in price. He attributed this rise to the fact that all American and Continental factories were full up with orders, and they practically ruled the prices, but these foreign factories had the advantage over them that they could and did combine, to obtain increased selling prices, while here in England any serious combination could not be effected, and although they had to pay more for their raw materials, they had not been able to recoup themselves by a corresponding increase of selling prices. While profits had suffered, the volume of the company's trade and their turnovers had increased, and all their factories had been able to work full time. They had to do a good deal more work to earn the profit. Their large enterprises at Witton had progressed favourably. The Witton engineering works had turned out an increasing quantity of dynamos and motors, especially for three-phase current. The report he could give upon their carbon factory was more encouraging this year. They had not reached the dividend-paying period yet, but they had been fully occupied at more remunerative prices, and this factory had continued to receive the orders and support of home, as well as Colonial, Governments, and of many municipalities. They had succeeded in turning out many new kinds of carbons such as flame carbons, and these were now of great help in keeping the carbon works well employed. In almost all the new carbons which they had turned out, they had succeeded in making a quality far superior to any of the Continental makes, and some of the arc lamps now burning could only burn with their carbons. He thought that after so much tribulation and loss, they might be proud of their carbon works. Debtors and stock had increased to over £70,000. The additional capital required had been partly provided by the directors by re-investing their dividends in ordinary shares. The policy of the directors had had one object so far well attained; that was constantly to increase the security of their preference shareholders. Six years ago, when the company started, the preference shares were secured by the existence of ordinary shares to the amount of £250,000; with this year's additions that sum, as increased by additional ordinary shares and reserve fund, amounted to over £450,000, a circumstance which the preference shareholders should take into account when valuing their property. He could not pretend to be satisfied with the profits which the company had been able to make during the last years. They were purely a manufacturing concern with its immense liabilities and risks, and a dividend of 5 per cent. on the ordinary share capital was not an adequate or encouraging return, being merely an interest which could easily be obtained on a non-risk and non-work basis. There was no water in their capital account whatsoever. The amount debited on account of goodwill was now fully covered by the reserves which they had placed on the other side. Those who knew the inner working of the business could testify that they had no dead weight—there was not a man in their employ who was not a working man. There was not a single machine in their vast factories that did not turn and work during 53 hours of the week—there was not a space in their warehouses that was not utilised. It could not be due to any internal deficiency, to any circumstance over which they had direct control that the capital invested did not produce a more satisfactory return. There must be some other reasons, and one, to his mind, was a most important cause of the present inability of their factories, as, indeed, of many other concerns in the country, to work at an adequate profit. Every one of the articles they manufactured had to be sold here, and everywhere in competition with international manufacturers. These manufacturers were assisted by their Government—they were not. The co-operation of industrials and their Governments abroad formed a powerful combination which they could never hope to fight successfully single-handed. Look what such a combination could accomplish. A German Steamship Company subventioned by their Government took from us the blue ribbon of the Atlantic. The late Government broke through the customary attitude of doing nothing, and subventioned the Cunard Company. The result was the launching of the *Lusitania*, which would regain for us the inestimable ribbon of the Atlantic. He had referred often before to the injustice they suffered from foreign tariffs. This year again Custom duties had been raised against them in Spain, Germany and France. The case of the French tariff was a particularly hard one to their firm. They had established a special house in Paris, under the title of the "General Electric de France," and had spent much money to push their manufactures in France. Suddenly, without warning, they were told they must pay as much as 50 per cent. more duty than before. They were powerless—the Government only could help them. If it did nothing, foreign nations would shut all the doors against them, and would increase still more the difficulties of large manufacturing concerns such as theirs. But not tariffs alone required an immediate co-operation between manufacturers and their Government; there were other anomalies and hardships under which manufacturers were obliged to work, unable to effect a remedy unless helped by the State. The common law affecting commercial cases required alteration. Large traders in this country suffered injustice daily almost rather than submit to the arbitrament of a judge and jury who had no technical knowledge and often were influenced by sentiment. Recently the Westinghouse Co. had to pay a very large sum to somebody who claimed that he had invented something for them. He believed a proper expert judge would have given quite a different verdict. Here they had a large company against a poor man. Twelve gentlemen who knew nothing about it gave the verdict. It was a costly, sometimes an impossible task, to teach technicalities to solicitors, counsel, judge and jury. They wanted a tribunal of judges supplemented by experts. The company law, especially the law regarding debentures, led to much wrong, made it difficult to give credit and often put a premium on swindling. He mentioned that because they suffered greatly from the law of debentures. Debentures should be a bill of sale and nothing else. At present, especially in the electrical trade, a man began with a small capital of a few hundred pounds, and then put on thousands of debentures for credit. It was not safe—it was not right. It was not common honesty that allowed it. He had always been taught that a man anywhere must pay his creditors—he could not give preference. In America, when a man felt he was going to smash he gave preference to one man, and the rest had to look out. That was an injustice. They always thought the English law would prevent that, but the company law actually helped that sort of thing by the law of debentures, which, at the present moment, was very irksome to this company, because out of one thousand customers at least 300 or 400 were limited liability companies now. It was not so bad ten or fifteen years ago, but now that everybody turned himself into a limited liability company the matter was very serious. He thought that the Legislature ought to do something to stop it. The Patent Laws were designed to favour the foreigner and to work against the English manufacturer. These laws allowed a foreign inventor to take out a patent for a few pounds, not to work the invention in England, but to hang up the industry for 14 years. In the electrical industry particularly they were sufferers from such antiquated patent laws. The present state of some industries—such as the telephone, polyphase machinery, lamps—was directly traceable to this cause. The chairman next referred to our canals and railway freights. Among other remarks on the latter point was one to the effect that they came across almost daily cases that proved that foreign goods were carried at a lower rate than English; the law of rating was at the bottom of this injustice, and Parliament should be asked to abolish it. He believed that the Government and the general public knew but very little upon the subjects which he had referred to and which so vitally affected their industries, and therefore the welfare of the whole nation.

Mr. Hirst seconded the adoption of the report.

Mr. Fred. Walker said that the company was earning 10 per cent. but did not divide up to the hilt. He thought the chairman took an unduly gloomy view of the prosperity of the industry. He was glad the chairman had recovered his usual health.

Another Shareholder asked whether it was not possible to do a little combination among electrical manufacturers here. There was undue competition which, if it were ended, would give another 5 per cent.

The Chairman replied that it was impossible here because, if they combined and raised prices here, foreign competition would be more severe than ever.

It was asked whether the ordinary shares were held entirely by the directors and staff.

The Chairman said that there had been a few in the market.

It was suggested that when the company wanted more capital, the preference shareholders might have an opportunity of taking up some ordinary shares. The report was adopted.

Consolidated Electrical Co., Ltd.

The directors' report just issued states that in September last the Canonbury business was disposed of to the Consolidated Supply Co., Ltd. The purchase price of £19,732 (payable as to £15,000 in 6 per cent. preference shares, and as to £4,732 in cash) represented the book value of the London premises, plant, machinery and stock-in-trade taken over. The Anglo-Portuguese telephone shares held by the company are now taken into the balance-sheet at their par value of £1 each, and their appreciation in price has enabled a reduction of £16,222 to be made in the item of goodwill. The value of the £15,000 6 per cent. preference shares of the Consolidated Supply Co., Ltd., received in part payment of the Canonbury business must necessarily depend upon the measure of success ultimately achieved by that undertaking. When this value is definitely ascertained, the item of goodwill can be further correspondingly reduced. Several items of doubtful value included in the previous accounts have been written off out of the past year's profits. The directors have been able to pay off during the year the whole of the arrears of dividend on the preference shares up to November 30th last. A further dividend on these shares, covering the period from December 1st, 1905, to March 31st, 1906, has been paid since the close of the year, and it is intended in future to pay these dividends half-yearly on or about January 1st and July 1st. Of the available balance of £12,079 standing to the credit of profit and loss account, the final dividend on the preference shares absorbed £300. The directors recommend the payment of a dividend on the ordinary shares of 3 per cent. for the year, which will absorb £3,300, leaving £8,479 to be carried forward. [Last year there was a net loss of £717.]

Great Northern, Piccadilly and Brompton Railway Co.

The accounts for the half-year ended June 30th show that the capital expenditure during the half-year has been £1,039,928. The estimated expenditure for the current half-year is £800,000. The progress of the works has been satisfactory. The rolling stock is now arriving at the rate of 15 cars per week. The surface buildings are progressing rapidly, and it is expected that the railway will be opened for public traffic throughout its entire length in January next. The running tunnels and station tunnels between Finsbury Park and Hammersmith have been completed, and the permanent way and conductor rails have been laid the entire distance, with the exception of a small piece at Covent Garden. The lifts, stairways and ventilation system are nearing completion. The substations are all completed and running, with the exception of Hyde Park Corner, which it is anticipated will be running early in September. The car-sheds and repair shops at Lillie Bridge have been completed, and are ready for the reception of the rolling stock. The rent due up to June 30th, 1906, from the Underground Electric Railways Co. of London permits of a dividend at the rate of 4 per cent. per annum.

South Wales Electrical Power Distribution Co.

According to the *Financial Times*, a circular was sent to the principal consumers of electrical power in South Wales by the debenture holders' committee of this company asking them to attend a meeting in Cardiff on Wednesday in order that the committee might discuss with the present and future consumers the position of the company. "The committee feel that it will not be possible to raise any further funds as authorised in the Bill now before Parliament unless the consumers in South Wales are prepared to at once enter into agreements to take such additional power as will justify the raising of the further capital. Should the necessary support be forthcoming the committee would be prepared to advise their friends to find the capital necessary to place the company on a sound working basis." It had been arranged that Mr. Charles H. Merz should attend the meeting to explain his views as to the present position and prospects of the undertaking.

An extraordinary meeting of the proprietors of the company will be held at the offices, Queen Street, Cardiff, on Tuesday, August 7th, for the purpose of authorising the creation and issue of prior lien debenture stock under the provisions of the Company's Act of 1906.

Metropolitan Railway Co.

The report for the half-year ended June 30th, 1906, states that the total receipts (deducting this company's proportion of the revenue of the City lines and extensions) have been £389,014, and the expenses £213,032, leaving a profit of £175,981. The receipts show a decrease of £51,316, and the expenses a decrease of £3,653, as compared with the corresponding half-year of 1905. The net revenue account, after providing for the interest upon the debenture stocks and other fixed charges and the dividend upon the preference stocks, shows a balance of £46,658 available for dividend upon the ordinary stock. The directors recommend a dividend on the ordinary stock for the past half-year at the rate of £1 10s. per cent. per annum, carrying forward £3,667. The falling off in revenue is due partly to the diversion of the Great Central Railway traffic to their new route, and also to the new and increasing competition of motor-omnibuses in London. From circumstances entirely beyond the control of the company, the electrification of the trains has not yet been completed, and the company is therefore not reaping the full advantage of the new method of working. The effect of this is that the working expenses are for the time being increased, and there has not been that development of passenger traffic which the company might reasonably have expected.

Electrical Development Co.

Our Toronto correspondent understands that the number of the board of directors of the Electrical Development Co. has been increased from five to eight. The new directors are Mr. W. R. Brock, Mr. E. R. Wood and Mr. A. M. Grenfell, of London, who will represent the English capital represented. A meeting of shareholders has been called for August 7th, and will be held in Toronto. The meeting will be asked to authorise the purchase of bonds and stocks in the Niagara Falls Transmission Co., a subsidiary company authorised to transmit power to New York State. A controlling interest will also be acquired in the Albion Power Co. and the Niagara Falls Gas and Electric Co., which will give the company the right to sell current for light, heat and power in 27 towns and villages in New York State.

City of London Electric Lighting Co., Ltd.—The interim report for the last half-year states that the number of customers being supplied was 11,969, with the equivalent of 853,006 8-c.p. lamps connected. There were 30,014 awaiting connection on completion of the consumers' wiring, delivery of motors, &c., as compared with 22,960 a year ago. The gross revenue from sale of electricity for public and private supply, and meter rentals, excluding sundry receipts, totalled £128,523, an increase of £4,027; while the net revenue was £55,318, an increase of £3,003. To this was added £22,235 brought forward, making an available total of £77,553. The lamps connected show a net increase of 34,051 during the six months, chiefly due to the continued demand for motive power. Both the gross revenue and net revenue for the half-year are larger than for the same period in any previous year. This result is attributable to the increase in the number of units sold, and to further reductions in the working expenses. There has been a considerable increase in the number of units sold, chiefly for power purposes, the total being 11,143,662 units, as compared with 10,050,465 units for the corresponding period of 1905. The directors have declared an interim dividend on account of 1906, of 5s. each on the ordinary shares.

Waterloo and City Railway Co.—The directors recommend a dividend on the ordinary stock at the rate of 3 per cent. per annum for the half-year ended June 30th last, carrying forward £738. This is at the same rate as for last year.

Blackpool and Fleetwood Tramways Co.—The directors have decided to recommend the payment of a dividend at the rate of 4 per cent. per annum for the half-year ended June 30th. The total revenue for the current half-year amounted to £11,204 11s. 3d., and the number of passengers carried was 877,825. The dividend last June was at the same rate.

Liverpool Overhead Railway Co.—The accounts for the past half-year show an available balance of £6,796 16s. The directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the (1892) preference shares, which will absorb £3,000, and carry forward a balance of £3,796 16s. 3d.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Wednesday, August 1st.—Anglo-Argentine Tramways Co.—Further issue of 100,000 ordinary shares of £5 each, fully paid, Nos. 430,008 to 510,007 and 560,008 to 580,007.

Bruce Peebles & Co.—3,000 ordinary shares of £5 each, fully paid, Nos. 17,001 to 20,000, and a further issue of 1,049 ordinary shares of £5 each, fully paid, Nos. 50,001 to 51,049, and 7,332 ordinary shares of £5 each, fully paid, Nos. 51,050 to 58,381.

Delhi Electric Tramways and Lighting Co.—100,000 6 per cent. preferred and participating shares of £1 each, 11s. paid, Nos. 1 to 100,000.

And ordered the undermentioned securities to be quoted in the Official List:—

Anglo-Argentine Tramways Co.—Further issue of 100,000 ordinary shares of £5 each, fully paid, Nos. 430,008 to 510,007 and 560,008 to 580,007.

Western Telegraph Co.—Further issue of £235,620 4 per cent. debenture stock.

Anglo-American Telegraph Co.—The directors have resolved to declare an interim dividend for the quarter ending June 30th, 1906, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on August 4th. There will be a balance of £19,695 to carry forward.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—An interim dividend on the ordinary shares at the rate of 10 per cent. per annum for the half-year ending June 30th, 1906, will be paid on August 8th.

Dublin United Tramways Co. (1896), Ltd.—The report for the half-year ended June 30th states that the amount available for division is £47,503. It is recommended that dividends be paid for the half-year at the rate of 6 per cent. per annum on the preference shares and at the rate of 6 per cent. per annum on the ordinary shares. £5,000 is placed to reserve and renewals account, and £2,000 towards maintenance in the current half-year, leaving £5,403 to be carried forward. The dividends are at the same rate as for last year.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th, 1906, at the rate of 4 per cent. per annum. This is the same rate as at June last year.

MARKET QUOTATIONS.

Wednesday, July 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	per cwt.	22/-	..
a " Oxalic	per cwt.	32/-	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a " "	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£15	..
a Benzole (90 %)	per gal.	10½d.	..
a " (50 %)	per gal.	10d.	..
a Copper Sulphate	per ton	£26	..
a Lead, Nitrate	per ton	£28	..
a " White Sugar	per ton	£31	..
a " Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90 % at 160° C)	per gal.	5/6	..
a Potassium Bichromate, in casks	per lb.	5½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	200/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a " Recovered	per ton	£5 10	..
a " Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	2⅞d.	¼d. inc.
a " Cyanide	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£160	..
b " Wire, in ton lots	per ton	£191	..
b " Sheet, in ton lots	per ton	£177	..
b Babbitt's metal ingots	per ton	£48 to £140	..
c Brass (rolled metal 2" to 12") basis	per lb.	9d.	¼d. dec.
c " Tube (brazed)	per lb.	10¼d.	..
c " " (solid drawn)	per lb.	9⅝d.	¼d. dec.
c " Wire, basis	per lb.	9¼d.	..
c Copper Tubes (brazed)	per lb.	1/-	..
c " " (solid drawn)	per lb.	1/-	¼d. dec.
g Copper Bars (best selected)	per ton	£95	£2 dec.
g Copper Sheet	per ton	£95	£2 dec.
g " Rod	per ton	£95	£2 dec.
e " (Electrolytic) Bars	per ton	£92	..
e " " Sheets	per ton	£104	..
e " " Rod	per ton	£95	..
e " " H.C. Wire	per lb.	11d.	..
f Ebonite Rod	per lb.	8/3	..
" Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/7	..
h Gutta-percha, fine	per lb.	6/- to 7/-	..
h India-rubber, Para fine	per lb.	5/0½ to 5/2½	inc.
i Iron, Charcoal Sheets	per ton	£18	..
i " Pig (Cleveland warrants)	per ton	50/6	2d. inc.
i " Forgings, according to size	per ton	From £11	..
i " Scrap, heavy	per ton	47/6 to 50/-	..
i " Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£17 to £17 2 6	7/6 to 10/- in.
g " " Sheet	per ton	£19 to £19 2 6	10/- inc.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot	£7 5	..
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d " " " medium	per lb.	2/6 to 4/-	..
d " " " large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/8	..
p " rolled bars & rods	per lb.	1/1½ to 1/8	..
p " " strip & sheet	per lb.	1/4	..
o Platinum	per oz.	nominal	..
e Silicium Bronze Wire	per lb.	1/- to 1/1	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
" " in bars		£15 to £40	..
g Tin, Block (English)	per ton	£171 10 to £172 10	£5 10 inc.
n " Wire, Nos. 1 to 16	per lb.	2/2	¼d. dec.
p White Anti-friction Metals— "White Ant" brand	per ton	£46 to £70	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£32	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Italy.—A company has been formed in Milan, under the title of Societa Forze Motrici Cismon Brenta, with a capital of 2,000,000 lire, to be raised to 3,000,000 lire. The company has for its object the acquisition of concessions for the appropriation of water-power, with a view to the production of electrical energy for agricultural and industrial purposes. The company will also undertake the manufacture of electric plant. The following companies have assisted in the formation of the concern:—The Societa Italiana Edison di Elettricita, the Societa Italiana per l'Utilizzazione delle forze idrauliche del Veneto, the Societa Anonima di costruzioni elettriche Brioschi, Finzi e C., the Societa Adriatica di elettricita and the Societa per lo sviluppo delle imprese elettriche in Italia.

STOCKS AND SHARES.

Tuesday Evening.

As regards price movements during the past week in the Electricity Supply division, very little of interest has to be noted. Bromptons have hardly been mentioned, and the same may be said of Charing Cross at 4-4½. The "City Undertaking" Preference changed hands in a small way at 3½-4, and are quoted fractionally lower. By the way, these shares are still quoted on two separate lines in the Official List, viz., the 1901 issue and the 1903 issue. Although the two issues have now automatically become identical in every respect, we understand that considerable formalities have to be gone through before the two issues can be quoted together. Chelseas at 5½-⅝ are unchanged, whilst the 4½ per cent. Debenture is still in demand on the basis of 106-8. Citys keep steady at 10½-½, a few bargains being booked on this basis. The 5 per cent. Debenture at 123-125 is wanted by investors. Countys eased off a little to 8-½, but the Preference are a firm market at 11⅝-12.

A very fair business was done in Metropolitans, but shares continue to be offered, and the price has given way ¼ to 8½. St. James' are not a very lively market, neither are Westminsters, the price in both cases easing off fractionally. South Metropolitan Electric Light 4½ per cent. Debenture has been inquired for, but no dealings are recorded. This stock is so well held that it is very seldom any ever comes to market.

The Edmundson meeting held last Monday was rather inclined to be stormy, some of the shareholders making up for their reduced dividend by a few pungent remarks. On the week the Ordinarys show a fall of 10s. at 3½, whilst the Preferences close unchanged at 4⅝ after having been as low as 4½.

The Rosario Electric Company has circulated a prospectus offering 15,000 6 per cent. cumulative second Preference shares of £5 each at par, with the right of conversion by holders into Ordinary shares at any time up till January 1st, 1917. The issue appears to offer an attractive investment.

Amongst Underground Railway issues City and South London stock has fluctuated several times within narrow limits, and finishes unchanged at 42. Central London stock has kept hard, and marks an advance of 1 per cent. at 87, but the Deferred has fallen a point to 73·6 on Continental selling, although the dividend announcement is satisfactory enough.

Generally speaking, Tramway securities are lower on the week, with one or two exceptions. Anglo-Argentine Trams are 1/16 harder at 6⅞-7. Capes have risen ⅛ to 9/16-13/16, and London United Tramways Preference are ¼ harder at 8-½. On the other hand, all the Belgrano share issues have been put down, and buyers are conspicuous by their absence. Calcutta Trams have been offered down to 8, but close unchanged on the week at 8-½. The Preferences, however, remain steady at 5½-⅝, after having been 5 5/16-7/16.

It is rumoured that the £10 Ordinary shares of the Potteries Electric Traction Company, Ltd., are to be split into £1 shares. No doubt the idea is to make the shares more marketable, as at present they are seldom dealt in, and the market is a very narrow one. The price of the present £10 share is nominally 7-½, whilst the 5 per cent. £10 Preference share stands at about 8.

Turning to the Telegraph and Telephone section, it will be seen that alterations in prices are numerous. The number of rises and falls are pretty evenly distributed, and, although shrinkages are perhaps more in evidence, the tone of the market is steady to firm, with an upward tendency in some of the favourite stocks. In sympathy with other speculative stocks, Anglo "A" has fallen something like two points, and a very large business has been put through in the stock. The dividend hardly came up to expectations. The 6 per cent. Preference stock is fractionally harder at 113. Commercial Cable 4 per cent. Debenture was wanted for investment purposes, and rose ½ per cent. to 98-99. Direct United States Cable shares have advanced ¼ to 16, and Eastern Telegraph stock has also been in demand at an improved value. Great Northern of Copenhagen have lost their rise of the previous week, and are back to 40 again. Marconi shares have slumped severely to ⅝-¾, and even at this price the market in them is none too firm. In National Telephone issues the Deferred stock and third Preferences have advanced in price, whilst the first Preferences and 4 per cent. Debenture stock have given way. United River Plates are quoted 6½-7. The new shares are now being dealt in for the special settlement at 1¼-1½ prem.

In the manufacturing division the feature has been the sharp rise of British Westinghouse Preferences to 1⅝-2¼. British Insulated Ordinary are fractionally lower.

An Exhibition of Travel.—We are informed that arrangements are being made for a travel exhibition to be held in London in June, 1907, and it is anticipated that everything connected with travelling in all parts of the world will be on view.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905.	Closing Quotations July 17th.	Closing Quotations July 24th.	Business done week ended July 24th, 1906. Highest	Lowest.	Rise + or Fall —
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..
155,600£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	5 %	80 — 85	80 — 85	..	..	..
702,600	Anglo-American Telegraph	Stock	60/6	61s.	2¾%	3½%	65 — 67	65 — 67	..	..	..
3,148,700	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5⅛%	6 %	112½—113½	112½—113½	113½	112⅝	..
3,148,700	Do. do. do. Deferred	Stock	1/-	2s.	Nil	½%	22⅜— 22¾	20⅜— 21	22⅛	20⅜	—1½
50,000	Anglo-Portuguese Tel., 5% Mort. Deb. Stock Red.	100	..	..	..	..	101 —103	101 —103	..	..	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	8 %	7⅞— 8⅛	7⅞— 8⅛	8⅛	..	..
1,982,856£	Commercial Cable Stlng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	97½— 99½	97½— 99½	98¼	97¾	..
16,000	Cuba Telegraph	10	6¼%	10 %	5 %	5 %	8½— 9	8½— 9	..	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %	17 — 18	17 — 18	..	..	..
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..
60,710£	Direct United States Cable	20	8½%	8 %	8½%	4½%	15⅜— 16½	15⅜— 16½	16⅛	15⅞	..
65,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	141 —144	142½—145½	144½	143½	+1½
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	89 — 91 xd	89 — 91	90⅝	89	..
1,948,772	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	107 —109	107 —109	108½	107	..
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	14 — 14½ xd	14 — 14½	14½	14	..
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	106 —108	106 —108	..	..	..
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
180,887	Globe Telegraph and Trust	10	£3	5⅛%	5⅛%	5⅛%	10⅝— 11⅛	10⅝— 11⅛	11⅛	10⅞	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	14⅝— 14¾	14⅝— 14¾	14⅞	14⅝	..
150,000	Great Northern Telegraph, of Copenhagen ..	10	12½%	15 %	24 %	24%	39 — 41	39 — 41	39½	..	..
37,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	13 %	57⅞— 59½	57⅞— 59½	59½	59¼	..
251,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1 — 1⅛	1 — 1⅛	21/-	19/4½	—1/8
72,680	Monte Video Telephone Co., Ltd. Ord.	1	8 %	8 %	4 %	..	1⅞— 1⅞	1⅞— 1⅞	..	..	..
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	⅞— 1	⅞— 1	..	..	..
1,383,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	110 —112	110 —112	111½	110¾	..
1,666,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %	109 —111	110 —112	111½	110½	+1
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13	..	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10 — 12	11⅞	..	..
350,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅞— 6	6⅛— 6⅞	6⅞	5⅞	— ⅛
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	96½— 98½	96½— 98½	98⅜	..	..
1,689,593	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	102⅜	..	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6¾%	6¾%	7½%	1⅞— 1⅞	1⅞— 1⅞	..	..	..
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅛	..	..	—1/16
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	..	4 %	97 — 99	97 — 99	97½	97	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	5 %	7¼— 7⅜	7¼— 7⅜	..	..	..
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	..	4½%	100 —103	100 —103	..	..	..
3,201	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..
70,000	United River Plate Telephone	5	7 %	8 %	8 %	8 %	6½— 7	6¾— 7	6⅞	6⅛	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼— 5½	5¼— 5½	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	108 —111	108 —111	..	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	4 %	9½— 10	9½— 10	..	..	..
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	Nil	⅞— ⅞	⅞— ⅞	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 — 102	99 —102	..	..	..
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	5 %	14½— 14¾	14⅞— 14¾	14⅞	14⅝	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	5 %	.. — ..	.. — ..	..	..	..
868,380	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— ½	9/9	..	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %*	7 %*	6 %	5 %	6 — 7	6 — 7	6⅝	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	4½— 5½	4½— 5½	5½	..	..
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..

Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

170,000	Anglo-Argentine Trams, 260,008 to 430,007	5	..	..	8 %	8 %	6⅞— 7	6⅞— 7 1/16	7 1/32	6⅞	+ a
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	..	5 %	5 %	5½%	5⅞— 6	5⅞— 6	5 15/16	5 15/16	..
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	138 —141	138 —141	..	..	..
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	..	5 %	5 %	5 %	102 —104	102 —104	103⅜	103⅛	..
800,000	Babcock & Wilcox, 1 to 580,000	1	..	17 %	20 %	20 %	3⅞— 4	3⅞— 4	78/9	76/3	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	..	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	..	7 %	7 %	3¾— 4	3¾— 4	..	..	..
40,000	Do. do. 7 % Cum. Pref.	5	Nil	Nil	7 %	7 %	6 — 6¼	6 — 6¼	6¼	..	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	6 %	6 %	5 — 5¼ xd	5 — 5¼	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	4 %	4 %	4 — 4½	4 — 4½	..	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	101 —105	101 —105	..	..	..
300,000	British Columbia E. Rail Def. Ord. Stock	100	..	6 %	6 %	6 %	116 —119	116 —119	117½	..	..
800,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	5 %	107 —110	107 —110	107	..	..
115,000	Do. 5 % Cum. Perp. Pref. Stock	100	..	5 %	5 %	5 %	105 —108 xd	105 —108	105¼	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	103 —105	103 —105	..	..	..
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	101 —104 xd	101 —104	..	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	3 %	5⅜— 5⅝ xd	5⅜— 5⅝	5⅝	5⅜	..
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %‡	8¾— 9⅛	8¾— 9⅛	9⅛	8¾	..
1,415,422£	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	109 —113	109 —113	112½	111	..
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	4½%	89 — 92	89 — 92	91	90	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %	6¼— 6⅜	6⅜— 6⅝	6 5/16	..	— ⅛
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾— 6¼	5¾— 6¼	5⅞	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	..	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	..	6 %	Nil	..	1½— 2	1⅝— 2¼	38/9	..	+ ½
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	..	4 %	4 %	4 %	77 — 83	77 — 83	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	2½%	⅝— ¾	⅝— ¾	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	6 %	1½— 2	1½— 2	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	82 — 84	82 — 84	..	..	..
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	3 %	3 5/16— 3⅜	3½— 3¾	67/6	66/3	— 1/16
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	6 %	5⅜— 5⅝	5⅜— 5⅝	5⅝	..	..
27,500	Do "B" do. 1 to 27,500	5	..	6 %	6 %	6 %	5 — 5⅛	4⅞— 5⅛	5 1/16	..	— ⅛
817,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	104 —106	104 —106	105	104½	..
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	101 —104	101 —104	102	..	..
105,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	8 %	8 — 8¼	8 — 8¼	8 1/16	8	..
32,610	Do. 105,001 to 137,610	5	..	..	..	8 %	7⅞— 8¼	7⅞— 8⅛	7⅞	..	— 1/16
850,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4½%	4½%	102 —104	102 —104	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	15%	10⅜— 11⅛	10⅜— 11⅛	10 15/16	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅞— 6⅛	5⅞— 6⅛	5⅞	..	..
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	108 —110	108 —110	..	..	..
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 %‖	⅜— ½	9/16— 11/16	..	..	+1/16
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	6 %	1 3/32— 1 5/32	1 3/32— 1 5/32	..	..	..
230,211	Do. do. 4½ % 1st Mort. Deb. Stock	100	..	4½%	4½%	4½%	97 —102	97 —102	..	..	..
1,939,698	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87	86¼	..
580,316	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	99 —101	99 —101	99½	..	..
580,316	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	74 — 77	73 — 76	75	74¼	—1
480,000	City and South London Railway	Stock	3½%	2¾%	2½%	1⅞%	42 — 44	42 — 44	43¼	42¾	..
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	2½%	2½%	..	1 1/16— 1 1/8	1 1/16— 1 1/8	37/6	35/-	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 — 97	94 — 97	..	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends. ‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations July 17th.	Closing Quotations July 24th.	Business done week ended July 24th, 1906.		Rise + or Fall—
		†	1902.	1903.	1904.	1905.			Highest	Lowest.	
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	..	10 %	..	1¹¹/₁₆ — 1¹³/₁₆	1¹¹/₁₆ — 1¹³/₁₆	..	..	..
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	..	6 %	6 %	6 %	1⅞ — 1¹⅞	1⅞ — 1¹⅞	..	..	— ⅛
294,150	Do. do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	103 —106	103 —106	..	..	..
60,000	Dublin United Trams. (1896), 1 to 60,000	10	..	5½%	6 %	6 %	13⅞ — 14¼	13⅞ — 14¼	..	..	..
59,987	Do. 6 % Pref. between 1 and 60,000	10	..	6 %	6 %	6 %	14 — 15	14 — 15	..	..	..
800,000	Do. 5½ % "A" Debs.	100	..	5½%	5½%	5½%	95 —100	95 —100	..	..	..
800,000	Do. 5½ % "B" Deb. Stock	100	..	5½%	5½%	5½%	95⅛ — 96⅛	95 —100	..	..	+1⅛
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	Nil	5s 3¾d	..	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..
17,189	Do. "A" shares, 01—017,189	5	Nil	Nil	2s 3¾d	..	2¼ — 3	2¼ — 3	..	..	..
844,028	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..
100,000	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	90 — 95	90 — 95	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..
81,390	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	2 — 2¼	2 — 2¼	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	86 — 89 xd	86 — 89 xd	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9 — 9¼	9 — 9¼	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	93 — 97	93 — 97	..	..	..
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	..	3 %	4 %	4 %	3¼ — 3⅝	3½ — 3⅝	..	..	..
96,000	Greenwood & Batley 7 % Cum. Pref.	10	..	7 %	7 %	7 %	10 — 11	10½ — 10¾	..	..	..
80,000	Do. do. 5 % Mort. Debs.	100	..	5 %	5 %	5 %	101 —102	101 —102	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	15%	12 — 13	12 — 13	..	..	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5¼ — 5½	5½ — 5¾	..	..	..
41,978	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —103	107½	..	..
108,022	Do. do. Scrip. All paid	..	..	..	..	..	107 —109	107 —109	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10%	5 %	10%	17 — 18	17 — 18	..	..	..
87,500	†Liverpool Overhead Railway, Ord.	10	1½%	1⅝%	1½%	Nil	1¼ — 1⅜	1¼ — 1⅜	..	..	..
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	4 — 6	4 — 6	..	..	..
600,070	London United Trams (1901), 1 to 50,007	10	..	8 %	6 %	8 %	7 — 9	8 — 8½	8½	..	— ¼
399,930	Do. do. 60,008 to 100,000 (£6 paid)	10	..	8 %	6 %	8 %	4 — 5	4 — 5	..	..	..
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	..	5 %	5 %	5 %	7⅞ — 8⅜ xd	·8 — 8½	..	..	..
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	94 — 97 xd	92 — 95	..	..	—2
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	3 %	⅛ — ¼	⅛ — ¼	..	..	..
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	18/-	..	..
850,000	Do. 4½ % Deb. Stock Red.	100	..	..	4½%	4½%	100 —102	100 —102	101½	..	..
20,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	5	..	..	6 %	6 %	4¾ — 5⅛	4⅞ — 5⅛	98/1½	..	..
24,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	10	..	5 %	5 %	4 %	6¾ — 7¼	6⅞ — 7⅛	..	..	..
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	..	5 %	5 %	5 %	7½ — 8½	7¾ — 8⅛	..	..	..
245,000	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	100 —103	100 —103	..	..	..
37,850	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	15 %	32½ — 34½ xd	32½ — 34¼ xd	33⅜	..	..
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	—1
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	93 — 95	92 — 94	..	..	..
540,000	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3½%	100 —103	100 —103	102	100⅛	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3½%	3 %	Nil	Nil	1 — 1½	1 — 1½	26/-	..	..
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	Nil	Nil	2⅜ — 3½	2⅜ — 3½	..	..	—1
246,806	Do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	78 — 83	77 — 82	..	..	..

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	..	5 %	5⅛%	4 %§	5⅛ — 5⅜	5⅛ — 5⅜	5½	5⅛	..
50,000	Do. do. 4½ % 1st. deb. stock	100	..	4½%	4½%	4½%	101 —104	101 —104	103½	103	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8½	7⅞ — 8½	..	..	..
800,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..
80,000	Charing Cross and Strand Electricity Supply	5	10 %	8 %	8 %	5 %	4 — 5	4 — 5	..	..	..
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	86/3	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅜ — 4½	3⅜ — 4½	..	..	..
40,000	Do. do. 1903	5	..	4½%	4½%	4½%	3⅜ — 4½	3⅜ — 4½	..	..	..
420,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
44,486	Chelsea Electricity Supply, Ord.	5	4½%	5½%	6 %	6 %	5¼ — 5⅜	5¼ — 5⅜	..	..	..
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	107	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	6 %	10 — 10⅜ xd	10 — 10⅜ xd	10⅜	10⅜	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ — 12½ xd	11½ — 12½ xd	..	..	..
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	12¼ —125	12¼ —125	..	..	..
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102 xd	99 —102	..	..	..
40,000	County of Durham Electrical Power, Ord.	2	4 %	4 %	£3 7 0	4 %	2⅛ — 3 3/16	2⅛ — 3 3/16	..	..	..
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½%	5 %	8 — 9	8 — 9	8⅛	8	..
80,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	11½ — 12½	11½ — 12½	12	11⅛	..
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	4 %	3 — 4	3 — 4	60/-	..	..
80,000	Do. do. 6 % Cum. Pref.	..	6 %	6 %	6 %	6 %	4½ — 5	4½ — 5	93/9	..	..
820,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	100 —103 xd	100 —103 xd	101	100	..
10,000	Folkestone, 1 to 10,000	5	..	5⅛%	5⅛%	5⅛%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	..	5 %	5 — 5⅛	5 — 5⅛	..	..	..
75,000	Do. 4½ % 1st. Deb. Stock	100	..	4½%	4½%	4½%	101 —104	101 —104	..	..	..
13,000	Hove, 1 to 13,000	5	..	8½%	8½%	9 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..
10,000	Do. New (£6 10s. paid)	£3	..	8½%	8½%	9 %	6⅞ — 7	6⅞ — 7	..	..	..
37,300	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	99 —101	98 —101	..	..	— ½
7,300	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	99 —101	98 —101	..	..	— ½
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	12 %	12 %	10 %	10 — 11	10 — 11	..	..	..
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	5	Nil	Nil	3 %	4 %	2 — 2½	2 — 2½	..	..	..
60,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5⅛	5 — 5⅛	..	..	..
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..
200,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8½%	10 %	10 %	8¾ — 9¼	8 — 9	8⅝	8¼	— ¼
76,121	Do. 4½ % Cum. Pref. 1—71,106, £8 pd.	5	4½%	4½%	4½%	4½%	5 5/16 — 5 7/16	5 5/16 — 5 7/16	5⅛	..	..
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	109 —113	109 —113	..	..	..
250,000	Do. 3¾ % Mort. Deben. Stock Redem.	Stock	3¾%	3¾%	3¾%	3¾%	94 — 96	94 — 96	95½	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	99½	..	..
75,000	Newcastle-on-Tyne, 1 to 75,000	5	..	8 %	8 %	8 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..
75,000	Do. 5 % Pref., 1 to 75,000	5	..	5%	5 %	5 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	7½%	13½ — 14½	13½ — 14½	..	..	..
64,000	Do. do. 4 % 1st Mort.Deb.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..
18,500	Oxford, 1 to 96 and 407 to 18,810	5	..	6½%	7 %	7 %	6⅜ — 6⅞	6⅜ — 6⅞	..	..	..
80,000	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	97 — 99	97 — 99 xd	10⅜	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	12½%	10¾ — 11¼	10¾ — 11¼	..	..	..
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..
150,000	Do. do. 3¾ % Deb. Stock Red.	100	3¾%	3¾%	3¾%	3¾%	95 — 97	95 — 97	95½	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	4 %	2 — 2½	2 — 2½	..	..	..
60,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	13%	3 %	4 %	4 %	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..
103,700	South Met. Elec. Lt. & Power (Ord.	1	Nil	Nil	Nil	2½%	⅞ — 1	⅞ — 1	..	..	..
85,868	*(Late Blackheath and Greenwich* 7 % Pref.	1	Nil	7 %	7 %	7 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	24/-	..	..
148,292	*Dist. E.L.Co.)* 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..
50,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	3 — 4	3 — 4	..	..	..
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 4¾	90/-	..	— ¼
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	4½%	100 —102	100 —102	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13 %	10½ — 11½	10½ — 11½	10⅝	10⅜	— ¼
98,151	Do do. 4½ % Cum. Pref. (Originally 5 %—Red. to 4½ % from 31st Dec., 1905.)	5	5 %	5 %	5 %	5 %	5¼ — 5⅜	5¼ — 5⅜	5 5/16	5⅜	..

Shares not officially quoted :—Mackay Companies, ord., 73—75. Pref. 73—75.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

(Bank rate of discount 3½ per cent. June 21st, 1906).

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1906.

The returns of electrical exports and imports for the month of June show considerable reductions in value when compared with the amounts recorded in the previous month, and are practically at the average obtaining in 1905. The re-exports show an upward tendency.

The June values recorded were as follows:—Exports £115,113, imports £118,978, and re-exports £9,278, which compare with £138,461, £132,036 and £8,807 respectively, in the month of May, and with £129,552, £105,210 and £8,556 respectively, in June, 1905.

Considerable decreases are apparent in all the export items, excepting in electrical machinery and telegraph material, &c., the former of which shows a considerable improvement, and the latter a slight advance on the previous month.

Although the imports of electrical machinery are also somewhat higher than in May, yet they lag considerably behind the exports in value.

Telephonic material, always an important item of imports, this month amounted to £28,584, a considerable drop on the £35,720 recorded in May, but above the average usually obtaining.

A small export of tramway material was recorded during the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material, and electric bells.	Electrically-driven machinery.	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark	2,484	1,106	54	...	24	774	33	...	...	56	...
Germany	39	...	49	7	...	22	...	...	13	...	...
Netherlands	79	231	452	...	...	57	...	...	...	...	...
Dutch Borneo and Java	142	67	...	23	...	...	...	...	...	...	...
Belgium	120	10	213	19	161	2,188	...	...	120	...	...
France	49	...	3	7	...	168	174	29	...	58	...
French Indo-China	...	...	...	...	...	33	...	...	...	...	...
Portugal, Madeira and Portuguese Africa ...	232	21	141	50	682	346	...	...	87	...	384
Spain and Canary Isles	29	...	63	179	...	2,583	...	...	...	10	...
Italy	129	...	...	171	963	572	...	...	...	40	...
Austro-Hungary and Greece	18	...	...	26	...	...	...	...	14	...	...
Egypt	384	180	25	45	...	114	...	...	27	...	...
China and Siam	124	1,067	742	30	...	200	10	...	...	165	...
Japan	8,842	871	77	...	76	12,071	...	...	4	...	...
U.S.A. and Cuba	42	...	...	145	...	219	17	...	...	...	...
Mexico, Peru, Uruguay and Venezuela	95	46	...	312	...	854	...	...	...	867	208
Chili	595	136	132	203	110	62	262	...	...	...	...
Brazil	57	1,977	26	327	32	1,039	28	...	34	754	...
Argentine	2,364	2,785	9	145	30	8,294	144	...	651	370	...
Channel Isles, Gibraltar and Malta	146	822	536	15	...	15	29	...	4	...	...
British West Africa	9	531	76	12	...	163	5	...	...	...	...
Cape of Good Hope	365	684	301	329	...	557	31	...	...	9	...
Natal	856	2,267	608	445	30	8,743	83	...	...	1,826	...
Zanzibar, British East Africa and Mauritius ...	...	...	5	...	12	...	...	...	11	...	...
India	2,298	2,382	1,101	344	1,041	2,540	42	...	56	846	664
Burmah	375	...	11	...	...	108	23	...	9	18	...
Ceylon	35	367	9	15	...	...	66	...	15	10	...
Straits Settlements, Fed. Malay States and Labuan	443	82	134	79	20	92	53	...	19	54	...
Hong Kong	64	76	4	248	...	122	5	...	5	...	91
West Australia	441	200	25	...	461	826	...	...	...	...	...
South Australia	420	...	115	...	235	126	...	...	...	...	...
Victoria	365	...	...	29	15	2,784	23	...	...	...	...
New South Wales	1,427	147	267	630	22	2,519	112	...	325	343	...
Queensland	193	25	226	...	...	...	...	...	...	...	...
Tasmania	61	...	...	...	...	...	...	...	...	...	...
New Zealand	269	876	599	83	10	1,665	376	...	215	...	...
Canada	8	...	330	68	...	175	156	...	10	...	...
Brit. W. Indies, Brit. Guiana and Falkland Is. ...	94	...	5	...	...	25	27	...	40	...	...
Total, £	23,693	16,956	6,338	3,986	3,924	50,056	1,699	29	1,659	5,426	1,347

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	
Norway, Sweden and Denmark	231	194	...	42	...	644	144	...	8,102	...	...
Holland	760	3,133	564	3,561	...	3,581	289	5,509	1,539	...	...
Germany	3,987	7,104	807	348	20	4,068	314	184	1,210	46	...
Belgium	899	2,090	627	2,822	...	7,786	148	920	17,533	...	...
France	1,777	3,131	1,936	400	962	1,154	216	2,089	190	55	...
United States	1,888	3,577	818	214	...	18,107	132	346	10	1,086	...
Canada	...	...	...	...	...	1,600	...	...	...	...	...
Austro-Hungary and Portugal	4	...	...	...	...	80	...	...	...	...	...
Total, £	9,546	19,229	4,752	7,387	982	37,020	1,243	9,048	28,584	1,187	...

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£		
Various countries, mainly as above	1,995	610	226	81	26	1,163	32	112	5,033	...	...

TOTAL EXPORTS: £115,113

TOTAL RE-EXPORTS: £9,278

TOTAL IMPORTS: £118,978

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

ALTERNATING CURRENT INSTRUMENTS.

Dr. Sumpner has recently published three important papers on the above subject, a paper on the theory of phasemeters read before the Physical Society of London, a Presidential address to the Birmingham Section of the Institution of Electrical Engineers, and a paper read before the Institution in London. The Physical Society's paper was almost purely mathematical, and does not lend itself to discussion here, but the other two described the construction of, and the practical results obtained from, certain very interesting

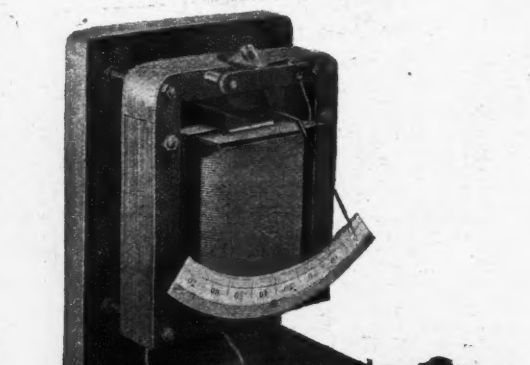


Fig. A.—Wattmeter, with Current Transformer.

designs. We understand that the scheme of the instruments is not Dr. Sumpner's, having been used by other designers before; and that his work consists in the examination of the conditions that must be observed in order to obtain accuracy, and of the extent to which these can be realised in practice. The care and thoroughness with which this has been done deserve much praise, and we are the more concerned to recognise this because the paper has been severely criticised by Mr. Franklin Stevens in the *Electrical Review* (New York), who finds in it evidence that English electrical engineers are behind the times, and that our ideas and practice in such matters are obsolete.

The instruments in question are moving-coil instruments of the same type as those ordinarily used for direct currents,

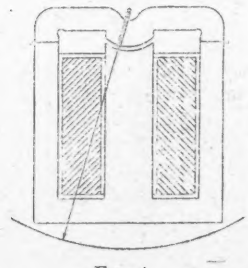


Fig. A1.

except that the permanent magnet is replaced by a laminated electro-magnet excited by an alternating current, and that the moving coil has no copper or silver former such as is used to damp the movements of a direct-current instrument. The general design is shown in fig. A and fig. A_1, taken from the Birmingham address. In his Institution paper, Dr. Sumpner discussed four instruments all of the same general design, only differing in the electrical arrangements. These are shown diagrammatically in fig. B, 1 to 4, where they are drawn in a form similar to that of the Weston direct-current instrument, though actually made as in fig. A.

Referring to the set of four figures B, each represents an instrument connected up to a pair of supply mains. The electro-magnets of figs. 1 and 2 are excited by the main current, those of figs. 3 and 4 by a shunt circuit. Speaking relatively, the ampere-meter of fig. 1 is of small importance. There has never been any difficulty in making sufficiently good ampere-meters, little accuracy being usually required, and we suppose few engineers would care for the complication of the two circuits necessary to this instrument, when the simple soft-iron instrument damped with an air cylinder and piston and working with one circuit is satisfactory. Again, the wattmeter of fig. 2 is shown by Dr. Sumpner to be much inferior to that of fig. 4. In fact, the two instruments of figs. 1 and 2 are mainly interesting as illustrations of the general theory of construction, though it is satisfactory to find that excellent amperemeters can be made on

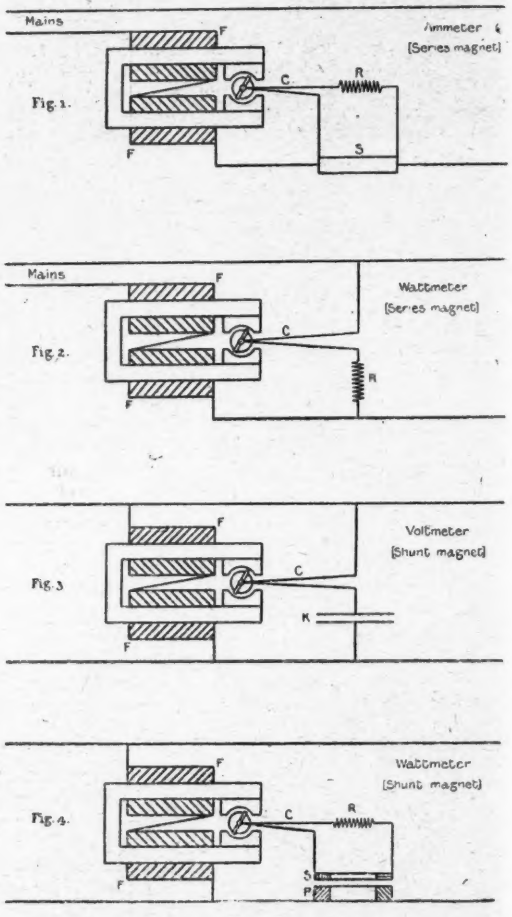


Fig. B.

those lines. The main interest of the paper lies then in the designs of figs. 3 and 4, and we confine our observations to these two.

In each case the force on the moving coil at any instant is the product of the instantaneous values of the magnetic flux in the magnet gap, and the current in the moving coil, and the position of equilibrium taken up will depend upon the average value of this product.

In each of these two instruments the exciting current is a shunt from the mains, and the impressed voltage is balanced by the sum of the inductive voltage due to the changing flux in the electro-magnet, and the fall of volts due to the resistance of the exciting coil. In an ordinary dynamometer the fall of volts due to the inductance of the shunt circuit is negligible compared with that due to its resistance, and the magnetic flux in the coil is in phase with the impressed voltage. But in these instruments the oppo-

site is the case. The fall of volts due to the resistance of the circuit must be negligible compared with that due to the inductance. If this can be secured, *i.e.*, if the ohmic drop in the coil can be neglected, the flux is strictly in quadrature with, and its magnitude is proportional to that of, the impressed voltage. Dr. Sumpner has discussed pretty fully the conditions that make this possible, and it is clear that by designing the magnet with a long narrow gap so as to reduce its reluctance as much as possible, and, if necessary, by a moderate increase of dimensions, the condition can be

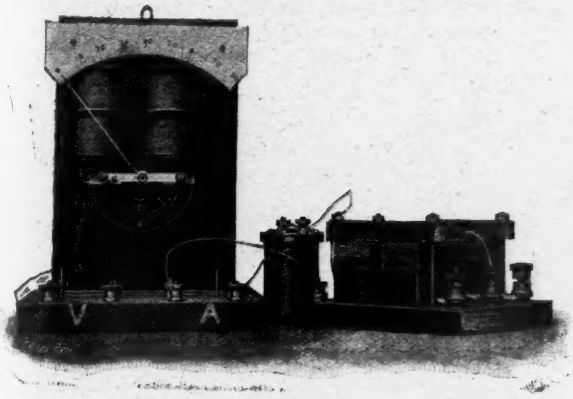


Fig. C.—Wattmeter with Resistance Coil and Current Transformer.
The magnet coil is wound in four equal sections which can be coupled in series or in parallel.

met very closely. It may be observed that since the impressed voltage is proportional to the total flux through the exciting coil, while the force on the moving coil is proportional to the field in the gap, it is necessary for accuracy that these should be proportional to one another, and that the general map of the distribution of the flux of the electro-magnet should be the same at every instant, differing only in the density. There is little doubt that this condition is fairly met by the provision of an air gap of large area and constant width, though if any part of the gap were much narrower than the rest, or if part of the iron circuit were closed, it would not be the case. It may be taken, we think, that an electro-magnet, such as is shown in fig. A, does give, or can be designed to give, a strong field in the gap in quadrature with, and proportional to, the impressed voltage of the mains, within any assigned limit of error.

Coming now to the currents in the moving coils, which move in a field in quadrature with the mains voltage, it is necessary in both instruments that they should be in quad-

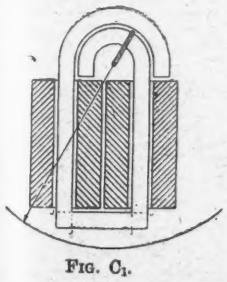


Fig. C_1.

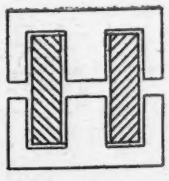


Fig. C_2.

rature with the impressed force, that of the mains voltage in the case of the voltmeter, that of the main current in the case of the wattmeter. This is provided for by the employment of a condenser in the voltmeter circuit, and of a transformer in the wattmeter circuit, which give currents in the desired phases provided certain conditions are fulfilled. The conditions for the voltmeter are that the condenser shall not absorb any energy by leakage or by electrical hysteresis, and that the circuit shall be non-inductive. The conditions for the wattmeter are similar: viz., that there must be no absorption of energy by magnetic hysteresis in the transformer, and that the secondary circuit which includes the moving coil shall be non-inductive. The first condition in both cases is met readily enough by a mica condenser in the one case, by an air transformer in the other. To arrange that the moving-coil circuit shall be sufficiently non-inductive seems to be a more difficult matter, and it is not clear to what extent it can be met. In an instrument designed by Dr. Drysdale, on the same general principle as we are discussing, and referred to by Dr. Sumpner, a second fixed coil is introduced into the air-gap of the electro-magnet, wound in an opposite sense to the moving coil and connected in series with it, giving an approximately non-inductive com

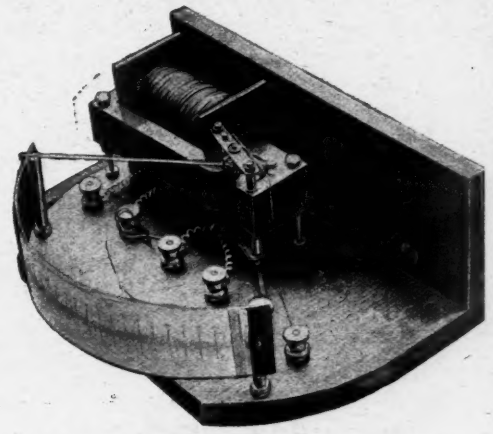


Fig. D.—Edgewise Instrument (cover removed) used as Voltmeter with Several Ranges.

bination. That design has the further advantage that the moving coil has no closed iron circuit. In either design the error due to the inductance of this circuit can be reduced to any extent by introducing non-inductive resistance at the expense in the wattmeter of the force on the moving coil.

In any case it is clear from Dr. Sumpner's figures that the error due to this cause can be reduced to a very small amount, and it is probable that it can be made entirely negligible without excessive reduction of the forces on the moving coil. If this be so, and the conditions for accurate working can be met as easily as appears, Dr. Sumpner has made out a clear case for the adoption of moving-coil

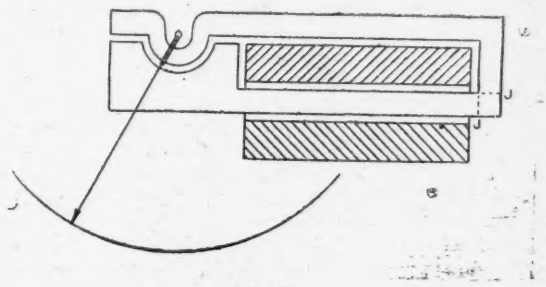


Fig. D_1.

instruments as normal instruments for alternating-current circuits, on exactly the same grounds that have led to their universal employment for direct currents.

Figs. C, C_1, C_2 show another form of the instrument—a wattmeter with its transformer. In this case the transformer, fig. C_2, has an iron core, which makes the construction more compact but increases the self-inductance of the moving-coil circuit.

Figs. D, D_1, is another form again, arranged in this case for a horizontal scale.

Mr. Franklin Stevens's condemnation of the scheme can only be explained by supposing that he has not really understood the case for it, but has received an impression, from the very care and detail with which Dr. Sumpner has discussed the conditions for accuracy, that these are difficult or even impossible. On the other hand, perhaps his familiarity with the portable dynamometer leads him to forget that the initial difficulties with that instrument were at least as great as those which present themselves here, though they were of a different kind. There they were mainly mechanical,

due to the smallness of the forces available, while here they are mainly electrical, the forces available being large and the construction involving little or no difficulty.

Before leaving this subject it may be pointed out that electrostatic instruments are probably capable of much wider application than they have received. In their case the electrical difficulties are small, as there is no heating, no temperature effect, no inductance to be considered, and the introduction of condensers cuts them off from the live circuits, and makes them very safe to handle. The mechanical difficulties due to the very small forces are met by hanging the moving part on a compass point, and forming the inductors as spherical surfaces struck about that point as a centre. Electrostatic instruments have been successfully used for insulation testing on a plan due, we believe, to Mr. Oswald Cox, and they have many advantages.

INTERFERENCE IN WIRELESS TELEGRAPHY AND THE INTERNATIONAL TELEGRAPH CONFERENCE.

By R. A. FESSENDEN.

(*Concluded from page* 114.)

2. *As Shown by Verified Tests.*—The foregoing official and semi-official tests were made with the old type of interference preventer, and while it is believed that the results obtained are much better than has generally heretofore been considered possible, they are far inferior to the results which have been obtained with the latest improved types of interference preventer.

Brant Rock.—Fig. 12 shows the work done in cutting out interference when working between Brant Rock, Massachusetts, and Scotland.

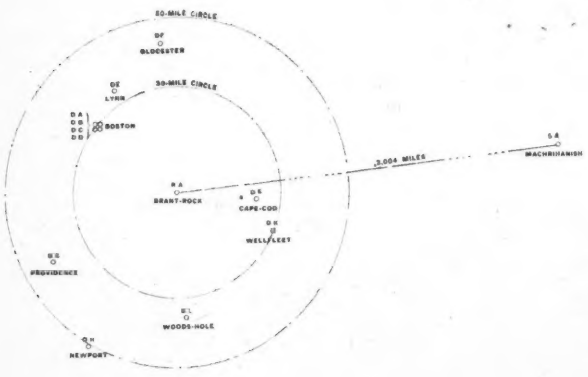


Fig. 12.

In the diagram, R A represents the Brant Rock trans-Atlantic station, distant a little over 3,000 land-miles from Machrihanish. It will be seen that there are 11 interfering stations within a radius of 50 miles from the Brant Rock station, and six within a radius of 30 miles. The power of these stations ranges from 3 H.P. at the smaller stations up to 15 and 20 H.P. at the Boston and Lynn stations, and about 50 H.P., it is believed, at the Marconi trans-Atlantic station at Wellfleet.

It will, of course, be obvious that the Brant Rock station would not have been located in this position if there had been any question as to the possibility of cutting out interference.

The results obtained justified the location, for, except in the case of Cape Cod and a high-power station at Boston which interfered intentionally, none of the other stations could be noticed when communicating with Machrihanish.

With reference to Cape Cod, the electro-magnetic waves from it were easily cut out, but the electrostatic effect gave some trouble until the proper arrangement was used, since which time its signals have been cut down until they are barely audible, and do not interfere with the receipt of messages from other stations. Some later improvements which have been made will entirely cut out the small trace of disturbance still left.

With reference to the Boston station, this gave no trouble while sending on its own tune, but the operators at that station received instructions to interfere purposely as much as possible; and as they succeeded in getting within 3 per cent. of the Brant Rock tune, and had a large amount of power at their disposal—10 to 15 KW.—they were able to interfere for several nights. This, however, afforded an excellent opportunity of testing some improved methods, and as a result it was found possible entirely to cut out this station, even when interfering of set purpose, so that signals were entirely inaudible, and, at the same time, to read messages from Machrihanish, the messages from Machrihanish being cut down only 50 per cent.

It would, of course, have been an easy matter to have used a different tune for sending from Machrihanish to what was used at Brant Rock, and to have eliminated the disturbance in this way, but it was considered that the opportunity of making a test as to the ability of the station to cut out malicious interference was too good to be lost, and owing to this fortunate circumstance some very important improvements were made in the way of cutting out interference.

Washington to Boston Test.—It was found possible to receive messages at Washington from Massachusetts, a distance of 400 miles, in spite of the fact that the U.S. Navy Yard at Washington, distant a mile and a quarter from the Washington station, was sending. The Washington Navy Yard was entirely cut out. While it is true that the wave-length of the Navy Yard is about 30 per cent. different from the Boston sending tune, the experiment showed that the wave-length might be very much closer without causing disturbance.

Interference Formula.—The following formula applies approximately, when the interference preventer is used—

$$\frac{(\text{M D})^2\, d\text{F} \,.\, \text{P S}}{(\text{M S})^2\, \text{P D}} = \text{C}.$$

Here M D is the distance of interfering station D from receiving station R, at which station D interferes with receipt of messages by R from sending station S.

M S = distance of S from R,
P S = power of sending station,
P D = power of interfering station,
d F = difference between frequencies of sending and interfering stations divided by frequency of sending station,
C is a constant.

The value of the constant C as a rule lies between 10^5 and 10^6, depending upon circumstances. The formula is, of course, not quite correct, as a great deal depends upon the capacity of the aerials, &c. It agrees fairly well, however, with the results obtained in practice.

Under ordinary conditions, unless an interfering station is nearer to the receiving station than 1 per cent. of the distance between the receiving and transmitting stations, it will not produce any disturbance where an interference preventer is used at the receiving station.

This does not apply to the latest methods of sending and receiving wireless signals, as with them it does not matter how close the interfering station is, and in a later article I shall describe tests showing that messages can be received on an aerial while at the same time the same aerial is being used for transmitting messages to another station without the transmitted messages interfering in any way with the received messages. I am aware that this statement will hardly seem credible, but I would ask for a suspension of judgment until the patent situation is such that I can publish a description of the apparatus and test.

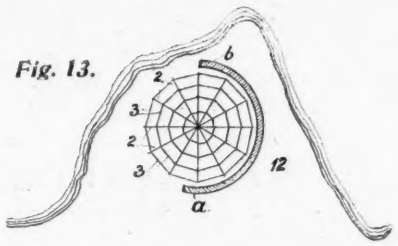
Directed Messages and Unpublished Methods.

The question of directing messages is one which has occupied the attention of a great many workers in the wireless field; but here, again, the statements made are, as a rule, quite unreliable. An exception must be made in the case of Marconi's work on horizontal antennæ, which is an entirely practical and reliable method, within the limits pointed out by Marconi.

With reference, however, to the statements made by other experimenters to the effect that they have succeeded in throwing signals in only one direction, these statements are entirely incorrect. Even an elementary knowledge of optics shows that even if a wave train could be started in one direction it would immediately spread out and act as a new source. Hence all statements that waves can be projected in a single direction by the use of three or more antennæ are absurd. In order to obtain any effect of projection, the dimensions of the reflector must equal a great number of wave-lengths. Suppose a wave-length of ¼ mile were used, then the reflector would have to be about 25 miles in diameter, and even then there would be a good deal of loss.

The writer has used several methods, most of them not very efficient, however. One method in connection with the wave chute is shown in fig. 13. Another method, shown in

Fig. 13.



figs. 14 and 15, consists in using a bundle of horizontal iron wires stretched at a little height above the ground, the wires being about 1 mil in diameter, and laid so as to be perpendicular to the direction of receipt of the waves. A shield is used behind the layer of horizontal wires for the purpose of cutting out the waves coming from behind.

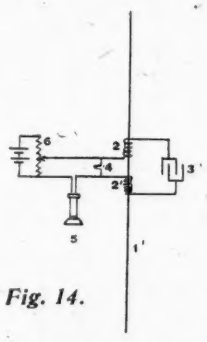


Fig. 14.

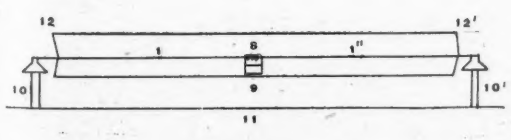


Fig. 15.

This method has the advantage over the horizontal copper wire in that the horizontal copper wire only shunts the ground, and hence the signals are weakened. On the other hand, the horizontal iron wires gather in, according to my experiments, a much larger fraction of the energy, and, moreover, as the length of the horizontal iron wires when tuned is less than the length of the horizontal copper wires, the apparatus is more compact.

A much more efficient method is the one shown in fig. 16. Here A is a tank, filled with distilled water, B, and having a layer of oil on top, D, to prevent evaporation. C is a copper cylinder connected through the secondary of an Elihu Thomson transformer, E, and grounded at F. G is a metallic reflector. The walls and bottom of the tank are made of asphalted brick. The secondary of the Elihu Thomson transformer is connected to the usual oscillatory circuit or to a high frequency dynamo.

In this device the water has about 80 times the specific inductive capacity of air, and hence the wave-length is approximately nine times as great and the energy is 80 times as great. Nearly pure water is an insulator for these high frequencies, while at the same time it maintains its high specific inductive capacity, provided it is not allowed to freeze. By this construction a metallic reflector can be used, which has many times the wave-length, without obtaining abnormal proportions. For instance, if the cylinder is 1 ft. high, it will radiate as much energy as a cylinder of the same diameter 80 ft. high, and if the tank reflector be 100 ft. in diameter, there will be quite a strong focusing of the waves. For stationary work, the front wall of the tank should be made flat and not circular, and a wave chute should also be placed in front. In regular working, the whole tank should be covered on all sides except the bottom by a well varnished board framework, so as to prevent absorption of the waves.

One advantage of this method is that on account of the energy being localised, a less amount of energy is required, and hence the capacity of the cylinder can be made relatively small, and still be effective over long distances.

New Methods of Work.—With reference to unpublished methods, the fact will be appreciated that it is not advisable to publish methods until the patents have been filed for a considerable time. This much may be said, however, that the present types of sending and receiving apparatus will soon be entirely superseded by methods employing no spark gap in sending and producing indications at the receiving end by direct electro-dynamic action. With this type of apparatus there is no trouble whatever from interference or from atmospheric disturbances, and it possesses many other advantages which it is not necessary to go into at the present time.

Suggested Method of International Working.

The writer has given elsewhere (Hysteresis in Social, Moral and Economic Functions) a proof of the following deduction :—

"Deduction 7. The only proper function of a government is insurance."

It is unfortunate that the abuses which have accompanied the independent control of public utilities, should have led governing bodies to attempt to operate these public utilities instead of controlling their operation by the Government's power as landlord.

In the official report of the Ontario Power Commission, I have given the reasons why, except within certain very narrow limits, governing bodies should not operate public utilities. I there point out that engineering improvements are only

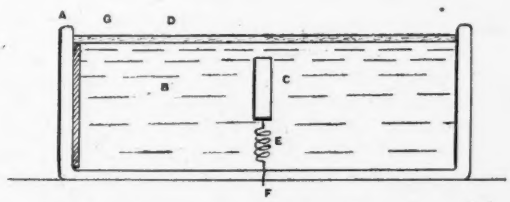


Fig. 16.

made through the expenditure of large sums of money for experimental work, and refer to instances within my own knowledge of the expenditure of 2½ million dollars in developing a new method of making window glass and the expenditure of five hundred thousand dollars in developing an electrical invention. To quote from my report :—

> It can hardly be questioned that the executive head of a municipality or State would not feel justified in spending several million dollars of public money in attempting to develop an engineering improvement, in view of the fact that only a small fraction of such attempts are successful.
>
> Further, communities and their executive officers would generally lack the incentive of personal and corporate gain, especially if all similar undertakings were under State or municipal control, and would therefore to such extent be deterred from advance.
>
> It is true that under State or municipal operation some minor and sporadic developments may be expected, but nothing of a general or important character. Important developments generally come only from the hands of individuals or bodies responsible only

to themselves, and provided with the incentive of a large profit. The elimination of self-responsibility and incentive would inevitably produce a condition in industrial and scientific development analogous to the Dark Ages.

In their proper functions of insuring the safety of ocean traffic, the Governments have undoubtedly a right to enact such regulations as shall provide for this in the greatest degree possible. In their functions of insuring a stable form of government, they have the right to take such steps as shall secure, in time of war, at least, the highest efficiency of their navies. This latter right should be exercised with due regard to the fact that the normal state of the nations is one of peace, so far as this can be done without decreasing the efficiency of the service.

These governmental rights can, it is believed, be secured, without interfering with the rights of the individual, in the following way :—

(*a*) By the international adoption of two different wave-lengths, one for mercantile use, and the other for navy and army use. The two wave-lengths chosen might be, for example, 500 metres for mercantile work, and 550 metres for army and navy work.

(*b*) Stations operated by companies or individuals should not be allowed to operate within 5 per cent. on either side of the two wave-lengths chosen—*i.e.*, should 500 metres and 550 metres be the two wave-lengths chosen, private companies should not be permitted to use wave-lengths between limits of 475 and 575 metres.

It might at first appear as if a separate wave-length should be used for signals of distress, but, on consideration, it will be seen that this would be inadvisable. A station which might be in range and capable of giving assistance might be talking on some other tune at the time the signals were received, and hence might fail to notice the signal of distress. The only proper signal of distress would be the repetition of a single letter, as a single letter can always be heard, sooner or later, through interference. All vessels within hearing should be required by law to immediately cease operating on hearing this signal of distress, and to answer it in a prescribed manner.

Inasmuch as it is possible to select signals within a quarter of 1 per cent., it is evident that the allowance of 5 per cent. on either side of the international wave-lengths allows for some 40 different tunes, which number, in my experience, will be found more than ample for all practical purposes.

It is believed that the international adoption of two wave-lengths as suggested above would solve all the difficulties which are at present met with.

RAIL CORRUGATION: A REVIEW.

Speculation as to the cause or causes of the phenomenon of the longitudinal corrugations which have been suffered for many years in isolated instances, but within the last five years have extended their operations throughout the world, and are well known to a large and always increasing number of tramway officials—speculation has been approaching a crisis, and now may be said almost to be emerging from the regions of surmise into a less foggy land. This has been brought about, as usual, by the gradual collection of evidence which is being subjected to a severe fining process.

The *Light Railway and Tramway Journal* published in December, 1903, the views of some who had formed theories from practical experience. Since then various people have joined in the discussion, and a *résumé* of the opinions expressed may be of value as indicating the direction in which a solution must be sought.

In 1903 the question was discussed cursorily at a meeting of the Tramway and Light Railway Officials' Association, when conflicting statements were made as to the usual *locus* of the first corrugations, although the opinion that they appeared first on one of the rails of curves seemed to find general acceptance. On the other hand, nothing could be suggested more than tentatively as originating the trouble. The shot in the dark of one was that electricity had something to do with it ; electricity, the origin for some of all good and evil.

Another speaker thought that constant braking over certain stretches of rail might be at least a contributory, and Mr. W. J. Cudworth (N.E. Railway), Mr. F. C. Tempest (S.E. and C. Railway) and Walter Scott, Ltd. (Leeds Steel Works), all express the same view in the *Light Railway and Tramway Journal*, so that it must be treated with the respect which is due to competent authority, although the last firm are not users of rails, and say that they are unable to suggest any reason why the wear, which must have arisen from the use of brakes or from the slipping of the car wheels on the rail should be so uneven as to produce corrugation.

Mr. Smith, of Leicester, also holds the "braking" theory, for he says, in the June issue of the above *Journal*, that corrugations are most perceptible just before a compulsory stop, which indicates that the brakes have a great deal to do with it, and his opinion is strengthened by finding that they do not occur on curves. It is well to say here that in this his experience is at variance with almost all the experience of which there is any record.

It is well to note particularly that only two engineers of our heavy railways have observed corrugations, and those not at all where speeds were high, but rather where they were at their lowest, and we may draw the conclusion fairly that there is nothing provocative of corrugation in the track of standard railways, while we may agree very well with the fundamental statement that the most likely action to produce such a strange effect is the alternate skidding and rolling of wheels.

It is easy enough to picture the genesis of depressions under the action of skidding wheels, but not so easy to understand why they should persist, unless we assume that skidding begins generally at the same point, and that the periodicity of the alternations between rolling and sliding is fairly constant, although it is also reasonable to assume that when once the smallest depression is formed, the tendency of freely rolling wheels is to bump into it from the adjoining crest and to perpetuate and deepen it in that way. Similarly we may imagine a whole series of waves propagated from a single source independently of any further skidding.

Probably greater light could be shed on this if Messrs. Cudworth and Tempest disclosed more fully the nature and degree of the phenomenon as it occurs at the stations on their lines.

In Hull the corrugations appeared first "on a curve of very large radius where the cars ran at high speed," and it came later to straight rails over which also there was quick running.

Mr. Fell records in his recent report to the L.C.C., that in this country the worst corrugations appear at curves and on the outer rail first. He says that they are found in almost every tramway in England and America. With regard to the latter country, he does not say anything as to curves playing an important part, but mentions that the length of wave varies with the speed, being up to 8 in. long in Buffalo, where the cars run on some of the interurban lines at 20 to 30 miles per hour, and as much as 31 in. long on the Boston Elevated, where speeds are over 40 miles per hour.

Here, then, are conditions quite the reverse of those noted by Cudworth and Tempest, producing what we must take to be the same effect. In one set of cases (the English main lines) high speed on the open line never has set up these waves, while in the other (the tramways) they are said to be influenced in a marked degree by speed. That suggests first that the essential differences in construction between tramways and railways in England are responsible, and that the vibrations (assuming that they are vibrations) which induce material waves are killed, or cannot be started on the resilient track of a railway, while they are fostered and magnified on the relatively unyielding tramway.

It suggests next that if real corrugations have been observed on railways, and if they are the outcome of braking, there are at least two causes at work independently, for braking can have nothing to do with corrugations on those parts of a line where brakes are not used.

But the Buffalo interurbans and the many other American light electric railways on which corrugations have been reported are built very much like our railways, so that corrugations ought not to arise on them ; yet they do, and the evidence, so far as we have gone, leads to the con-

clusion that they can be neither caused nor cured by construction in one way or the other.

Once having granted that vibration is the instrumentative force, however generated, it is unnecessary to trouble about the varying length of waves, for it seems to follow naturally that this will vary with the speed of cars. The only thing to care about is the cause of waves of all lengths.

Up to this point there are indications that the line which research should take rather seems to be to ascertain the differences which exist between main line and tramway rolling-stock and permanent way, for, with rare exceptions, observed at a few stations, it may be said broadly that corrugations do not occur on steam railway lines in England, but that they are becoming universal on electric tramways.

The differences in permanent way construction are marked, and can be expressed most simply by saying that a railway is flexible and a tramway rigid.

If there were none but home evidence available, there would be a *prima facie* case for corrugations being caused by rigidly held and inflexibly bedded rails, but there is the American evidence quoted above from Mr. Fell's report, and there is the especially strong evidence of Mr. V. Angerer, vice-president of Messrs. Wm. Wharton, jun., Incorporated (*Light Railway and Tramway Journal*, December, 1903), who seems to have been investigating the subject for years. He has found corrugations occurring on elevated and surface tracks, on track laid on sleepers, and on the yoke and concrete construction of conduit tramways, on straight track and on curves, but *he has never found it on any regular steam railway.* We have not space to reproduce the whole of his contribution, but briefly, his theory is that corrugations are "produced through vertical vibration set up in the rail, which brings the surface in more severe contact with the wheels at regular intervals." The vibrations are set up at the joints, and the corrugations start at or near them, and are observed chiefly where either the supports of the rail were rather far apart, or where some of the wooden cross sleepers had sunk so that a considerable length of rail was suspended; also "where the supports are rigid like yokes laid on concrete, and where, therefore, the elasticity of the wooden cross ties does not counteract the setting up of vibration. This elasticity is the only explanation I have for not finding corrugations on regular steam railroads."

That is to say, the vibrating rail is "stopped" at such short intervals by the sleepers that serious waves cannot be formed, and that whenever enough of these stops are removed the mischief begins.

If it were possible to believe that sleepers are "washed out" only on tramways and never on railways in America, we should be more ready to accept this theory as plausible, but we have it from several sources, and from the present witness among them, that corrugations have not been found on railways. On many thousands of miles in America and this country there must have been a great number of opportunities during the last 20 years—to go back no farther—for exceptions to have helped to prove the witness's rule. Notwithstanding our unwillingness to accept this theory completely, the value of Mr. Angerer's observations is undisputed, and whoever investigates the phenomenon as it occurs in Great Britain, should pay minute attention to the way in which corrugated rails are bedded on the concrete. They should look also for the indents on the side of the railhead, which Mr. Angerer found and attributed to vertical movement of the rail, although it is probable that these marks are not confined to corrugated lengths.

Mr. Ayton, of Ipswich, finds that "in almost every case where corrugations have appeared the subsoil consists of loose ballast and sand, with water coming quite close up to the surface." This coincides well with Mr. Angerer's views, and he believes that if the rails had been laid like an ordinary railway the track would have killed the vibrations and corrugations would not have been formed.

Again, the Brussels Tramway Co. find that the corrugations "are generally more accentuated on the rail which is nearest to the extrados of the road, *i.e.*, to the point which gets most rain water."

There have been great variations in the percentage of carbon in the tramway rails of this country, and it is probable that they are harder than railway rails, as they naturally ought to be. It is conceivable that the great difference between the supports of railway and tramway rails would permit cold rolling to take place in the latter, but not so easily in the former, even though the steel of the railway rail were softer. That it does occur at every tramway joint which is not particularly carefully fished is common knowledge, but the question is under what circumstances this bump at joints develops into a series of waves? Whether analysis has much or all to do with it, ought to be discovered by the examination of a full set of corrugated specimens varying in carbon and manganese.

In the *Street Railway Journal*, for July, 1904, a German engineer wrote :—"Owing probably to the use of soft rails, German railways [used here in the American sense, meaning light railways or tramways] have been large sufferers through the wear of rails in waves or ridges, which was noticed in America before high carbon rails became so common in that country . . . . At first these ridges are formed for only a trifling distance, but once begun they are propagated very rapidly, and always in the direction in which the cars run. The most plausible explanation is that the wheel rolls the rail material before it, until the wave has reached a certain height, whereupon the wheels rise over the obstruction, and the process begins again."

Together with this suggestion, and in opposition to it, should be taken the case presented by Mr. G. Moyle, the engineer to the Bengal State Railways (*Engineer*, December, 1904, *Tramway and Railway World*, June 7th, 1906), which is the more remarkable because it refers to main line railways. He was troubled with what he calls appropriately roaring rails, and made analyses which brought to light that those rails are much *harder* than ordinary rails. "This sets up intense and undue vibration in the rail, which is enhanced when the track has resonant properties." Mr. Banister, of Norwich, quotes this authority in the *Light Railway and Tramway Journal* for June, and believes that the reason is the only one which is sufficient to account for the corrugation on his tram rails.

In the *Electrician* for February 16th, 1906, there is an editorial note in which the part contributed by rail composition is said to be caused by susceptibility to cold-rolling, which "seems to be associated with relatively low carbon and high manganese contents." It continues emphatically :—"Where tramway rails containing over ·55 per cent. of carbon, and under ·8 per cent. of manganese have been used rail corrugation is unknown." The authority for this assertion is not quoted.

Certainly the analysis of every specimen of corrugated rail which is to be used as an argument should be ascertained, together with the analyses of neighbouring rails which are not affected, although apparently subject to the same conditions.

Inquirers on this and other matters forget sometimes to take both kinds of evidence—positive and negative—before drawing a conclusion.

It will not have escaped attention that corrugation is attributed now to rails of the hardest and of the softest steel, and is difficult to reconcile such contradictory statements, while at the same time we are most unwilling to suggest that the observations of either side are incorrect, or, in fact, that they are really irreconcilable.

In any case, the rail is only the soil in which waves may be sown. If the analysis is of one order, perhaps no external influences could corrugate the surface, if it is of another, waves may be formed readily under certain circumstances. If the first analysis is satisfactory from other points of view, of course it will be used always in future, and nothing more will be heard of corrugations, but that will not bring us any nearer to isolating the active causes of them, and it is with that in mind that we are reviewing the subject now.

Another hypothesis is due to Mr. Fell, who thinks that waves may originate by very slight unevenness of the newly rolled rails "setting up a slight jumping action in the car wheels," as well as through unevennesses due to rail joints, and to wheels or track being out of gauge.

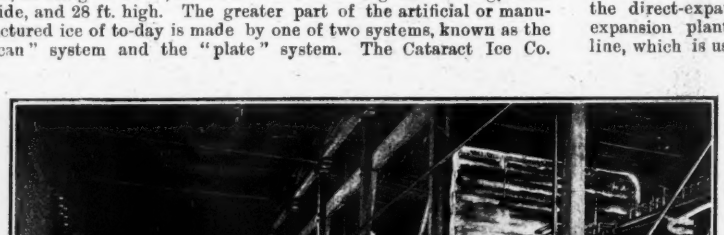
Several companies on the Continent attribute the mischief to want of homogeneity in the steel, and some "to the oscillations of the motors."

(*To be continued.*)

ELECTRICALLY DRIVEN ICE-MAKING PLANT.

By ORRIN E. DUNLAP.

What is believed to be the only electrically operated ice-making plant in the United States has been installed by the Cataract Ice Co., of Niagara Falls, in a new brick building 125 ft. long, 44 ft. wide, and 28 ft. high. The greater part of the artificial or manufactured ice of to-day is made by one of two systems, known as the "can" system and the "plate" system. The Cataract Ice Co. formerly used the "can" system, but, desiring to increase its output, as well as the quality of its product, it adopted the "plate" system.



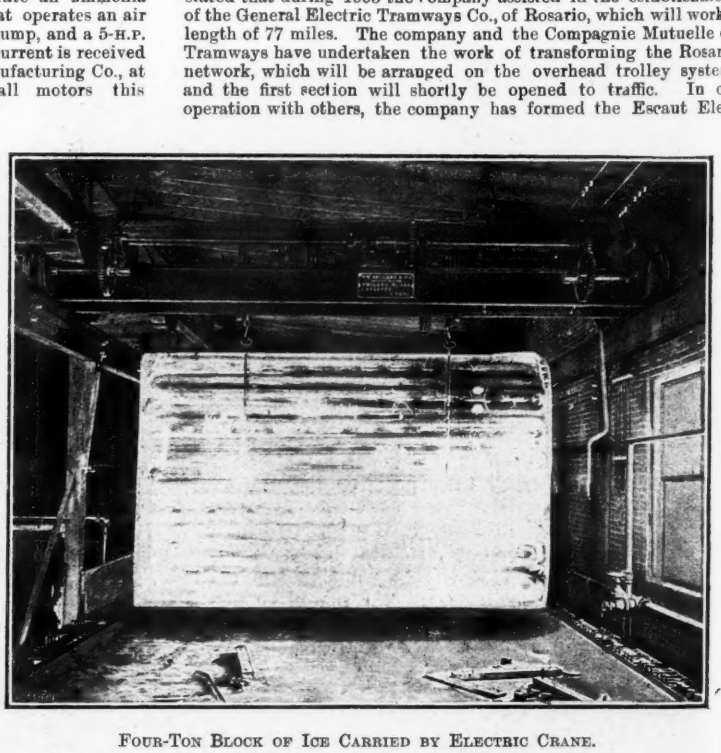
Ice-Making Plant; Refrigerating Tank on the Right Hand.

In Niagara Falls the popular power for the operation of factories of all kinds is electrical power, and the company has installed a 100-h.p. Westinghouse induction motor to operate an ammonia compressor; a 5-h.p. motor of the same type, that operates an air compressor; a 3-h.p. motor to drive the brine pump, and a 5-h.p. motor to operate an electric crane. The electric current is received from the Niagara Falls Hydraulic Power and Manufacturing Co., at 2,200 volts, and for the operation of the small motors this voltage is stepped down to 220 volts.

In this Niagara Falls plant the tank occupies a space 98 ft. long, 15½ ft. wide, and 9 ft. 9 in. high. This tank is divided into eight compartments, each containing four plates. One of these eight compartments is emptied daily, taking out eight cakes of ice, the approximate weight of each cake being about 4 tons, so that the plant has a daily capacity of about 32 tons. The weight of the daily output varies, of course, according to the thickness of the ice. Each cake of ice made is about 15 ft. 3 in. long × 9 ft. 6 in. wide, clear and transparent. Into each cake of ice, about 6 ft. apart, two iron rods, 5 ft. long and about 1 in. in diameter, are frozen, and in drawing the ice these rods are engaged by hooks at the ends of chains on the electric crane. After being raised from the compartment where it was made each cake of ice is conveyed by the crane to the rear of the building, where it is placed on a tip table and dropped to a horizontal position. At the present time saws operated by hand are used to cut the ice into small cakes, but an electrically-operated saw is to be installed. Out of each of the huge cakes 32 small cakes are made, and these are chuted to a storage room, where the ice is kept for delivery. The plant has a storage capacity of 3,000 tons.

The water is taken from the city mains. It passes through a condenser, and is pumped to the top of the building, where it is discharged into a tank of large capacity equipped with live steam coils. Here the temperature of the water is raised to 160° F., and by gravitation the water passes down through a flat cooler, which reduces it to a temperature of about 90° before passing through the filters, which have a capacity of about 15,000 gallons per day. From the filters it passes to the fore-cooler, or water storage tank. From this tank it passes, as it is used, by gravitation to the freezing compartment. In the operation of the plant, the anhydrous ammonia gas is compressed and thereby heated. It is then passed to a condenser, where it is brought into contact with water-cooled surfaces, thus reducing its temperature to the temperature of the water, and converting it into a liquid. It is then allowed to expand into coils, which are encased in the freezing plates. These plates being submerged in the water, ice forms on their outsides, and after a period of eight days a cake of ice has developed or grown. The system used is known as the direct-expansion system, but the trouble with old direct-expansion plants is obviated by the introduction of a reserve line, which is used in thawing off. After the hot gas has passed through the coils within the plates in thawing off the cakes from the plates, it becomes liquefied. It is then conveyed by means of this reserve header to another compartment, where it is expanded into the coils. It will be observed that in thawing off, the plates are used as a condenser. This eliminates the possibility of the liquid gas going back to the compressor, which was the difficulty met with in operating the old type of direct-expansion plate plants.

As it takes eight days for a cake of ice to develop, it is evident that could the period of freezing be reduced, the plant investment would be materially lessened. Experts are now trying to accomplish this.



Four-Ton Block of Ice Carried by Electric Crane.

Belgian Investments in Tramways. — The Société Générale Belge d'Entreprises Electriques, of Brussels, which is closely associated with the Loewe financial group of Berlin, realised from its tramway investments in 1905 net profits amounting to £19,600, as compared with £18,000 in the preceding year. This result has enabled the payment of a dividend at the rate of 6½ per cent. on the share capital of £240,000, as contrasted with 6 per cent. in 1904. In addition to Belgian undertakings, the company is interested in the Anglo-Argentine Tramways Co., and in other tramways in Italy, Denmark, Bulgaria, Turkey, and other countries. A second Belgian tramway enterprise is the Union Anversoise de Tramways et d'Entreprises Electriques, of Antwerp. In the course of the report submitted by the directors at the meeting on July 3rd, it was stated that during 1905 the company assisted in the establishment of the General Electric Tramways Co., of Rosario, which will work a length of 77 miles. The company and the Compagnie Mutuelle de Tramways have undertaken the work of transforming the Rosario network, which will be arranged on the overhead trolley system, and the first section will shortly be opened to traffic. In co-operation with others, the company has formed the Escaut Electricity Co., which is to supply the district of Antwerp with electrical energy, and has also participated in the construction of the Société Hispano-Belge de Chemins de Fer et de Tramways, and the present summer is to witness the inauguration of the first line, that is, from Malaga to Torre del Mar. The net profits of the Antwerp company amount to £48,000, and a dividend has been declared at the rate of 7½ per cent. on a share capital of £200,000.

THE ROYAL COMMISSION ON LONDON TRAFFIC.

The latest addition to the London Traffic Library is now complete in eight volumes. The last to be published is Vol. IV, which is concerned to the extent of 1,250 pages and 102 plates, with appendices to Vol. I, the Report of the Commission.

The series is an astonishing example of thoroughness, is well worthy of the grandeur of the subject, and deserves a much better fate than seems likely to be its lot. People already begin to think of this Commission as having sat sometime in last century, and will be inquiring soon what has been done to lessen the congestion in London streets.

Half the volume is taken up with the results of a Sub-Committee's visit to the States. The conditions in New York City are quite unlike those found in London, and are dependent on the long and narrow formation of Manhattan Island.

Elevated railways are not suited to the London streets, as everyone knows, without seeing them in New York.

Mr. Lynden Macassey, the learned secretary, supplies another description of the subway, which suffers, if anything, from over description. Nevertheless, the volume would have been incomplete without it, and probably Parliament does not know so much about it as our readers.

There are 1,300 miles of tramway track in New York, all controlled by the omnipotent Interborough Co., which owns the "Elevated" and works the Subway. Although the last 3½ miles of the Subway were estimated to cost 10 million dollars, the company agreed to make it for 2 millions. The L.C.C. would scorn to save 1½ million pounds like that. In Boston, too, the means of transport are all in the hands of one concern, the Boston Elevated Railway Co. All the facilities in New York have supplemented and not interfered with each other, and it is said that where all three systems are in operation at a 5 cent fare, passengers take the tramcars for one mile, the Elevated for from one to two miles, and the Subway for anything over, which leads to the remarkable conclusion that the species of undertaking on which least capital has been spent does the least work, but gets as much for it as the others.

While New York presents little likeness to London, Boston is what the secretary (possibly from the effects of overwork) calls its prototype. "With every extension of tramway mileage, the population has spread radially outwards."

The tramways did all the carrying work until congestion got to such a pitch that the speed of the cars in the business centre seldom exceeded 2 miles per hour, a state of things which it is not hard to parallel in modern London. In this case a subway on one side and an elevated railway on the other have brought the necessary relief, so that the problem was not anything like so difficult as ours. Greater Boston, having an area of 292 sq. miles, has a population of 1,147,000; that of Greater London, containing 693 sq. miles, which is considered by the Commission (*vide* Vol. I), had a population in 1901 of 6½ millions; 1¼ millions enter and leave the City of London every day.

The Commission says that Boston presents the best example of co-ordination anywhere existing.

In America generally workmen's fares are non-existent, and have been refused consistently by the Government. "There is a distinct tendency to abandon the practice of placing conductors on every coach of a train instead of on the station platform. . . ." If we mistake not, our underground railways will follow suit as soon as they begin to realise that they must pinch to pay.

Here is a pill for the Roads Improvement Association and the motor-omnibus fraternity:—"The evidence . . . . as to the regulating effect of tramways on general traffic is very striking. Tradition has it that two foot bridges were required in the sixties to enable pedestrians to cross Broadway at its lower end, but that, shortly after the introduction of horse cars . . . . conditions so much improved that the bridges were removed."

When our long-expected Traffic Board is created, we shall have to acknowledge the lesson taught by New York and Boston, where "co-ordination and control are effectually secured by *ad hoc* tribunals."

Sir John Dickson Poynder presents a report on the question of aiding the construction of railways into thinly populated districts, or the running of unremunerative trains by the aid of various easements or subsidies. "In many cases the additional trains could be put on . . . if the local authority were willing to forego its claim to the whole or to part of the increased assessment attaching directly to the railway . . . ." In other words, if the local authorities would stop killing the goose, they might have a chance of getting some golden eggs.

Sir George Bartley presents a report on means of transit in European cities. In all Continental cities tramways and generally urban railways are built on a concession which prescribes service, fares and routes. At the expiration of the concession the lines revert to the grantor under agreed conditions. That arrangement is not at all unlike the English procedure as between local authority and company, and we rather think that the profit-sharing arrangement between the City of Paris and the Metropolitan Railway Co. is not so unique as the report suggests. Whether that is so or not, Paris does well out of it, for in 1903, in spite of the fire, the company paid 5¾ million francs to the city, and the latter carried 3 million francs to relief of rates after paying interest on a loan of 72 million francs, which it raised for the railway. The concession is for 35 years. Another lesson which the L.C.C. has conned, but not kenned.

Then follow appendices on the Regulation of Traffic by Police; Area, Houses and Population of Greater London; History of London Traffic (which may be interesting, but is not essential), and the Building Laws in Greater London, none of which need keep us. Last, except for a complete bibliography and catalogue of works of reference, comes a summary of Mr. Stephen Sellon's examination into the tramway systems of the kingdom.

This appendix shows that where facilities for locomotion are provided the workman will remove from the centre of a town to the limit of the penny fare; and that the universal effect of a tramway is to appreciate the value of the property on its route. We know a county surveyor who has been in the habit of declaring any time this last five years that roads with tramways on them cost one-third more to maintain than they did before the paving was laid, and he had nothing but a strip on each side to keep, yet the Commission deduces from Mr. Sellon's report that in every town tramways have invariably resulted in a diminished cost of maintenance of the streets.

Certainly that will not please the Roads Improvement Association, to whom, by the way, we wish every success in their persistent struggle in the direction indicated by their title.

A Cape Town Action.—In the Supreme Court at Cape Town, judgment was given on June 18th by Sir John Buchanan in the action brought by the Metropolitan Tramways Co. against the City Council and the Cape Town Gas and Light Co. The action arose out of the explosion in Adderley Street, Cape Town, in June last, when a lady was killed and several people injured by the upheaval of about 200 yds. of the street surface. The tramway track, which was being relaid and the rails welded on the Thermit process, was on the point of completion, and was completely destroyed. The plaintiffs charged the Council with negligence in allowing a very high pressure gas main to be laid over a disused sewer in the way it was, and in blocking up the sewer in Adderley Street at both ends without any means of ventilation, whilst the charge against the Gas Co. was negligence in laying a high pressure main in contact with a sewer, and in not keeping the gas-pipes in proper repair. The Council denied that the explosion was caused by coal gas, declaring that it was due to plaintiffs' negligence in using the Thermit process for welding the rails. Sir John Buchanan, in summing up, said that the weight of evidence pointed to the fact that the principal source through which the coal gas, which caused the explosion, entered the sewer, was through the high pressure main which crossed the crown of the sewer. The gas was brought on the spot by the Gas Co., and it was impossible to hold that this was done without the knowledge and permission of the Council. Evidence of the experts showed that it was at a certain joint that the gas fed into the sewer. The running of the mains through the crown of the sewer was known to the Town Council, and was undoubtedly improper and wrong. Judgment was given for the Tramway Co. against both of the defendants jointly for £1,044 for replacing the rails blown up, and £250 for the loss of traffi also costs.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

15,471. "Thermopiles." H. ALEXANDER. (Date applied for under Patents Act, 1901, August 29th, 1905, being date of application in Germany.) July 9th. (Complete.)

15,499. "New or improved electric vulcanising apparatus." L. BINKO and THE PHŒNIX ELECTRIC HEATING CO., LTD. July 9th.

15,500. "Improvements in electric radiators." L. BINKO and the PHŒNIX ELECTRIC HEATING CO., LTD. July 9th.

15,501. "Electrically-controlled optical appliance." J. C. FREDELL. July 9th. (Complete.)

15,512. "New or improved switch for strong and weak electric currents." C. FEUCHTMEYER and O. KONITZER. (Date applied for under Patents Act, 1901, being date of application in Germany.) July 9th. (Complete.)

15,580. "Improvements in electrical controlling apparatus for flat-bed printing machinery." A. C. AUDEN. July 9th.

15,581. "Improved electric tell-tale for engine telegraphs." J. McM. MCINTOSH. (G. McIntosh on the High Seas.) July 10th.

15,587. "Improvements in insulators for electric rail or tramways." P. T. J. ESTLER and C. S. DRAKE. July 10th.

15,613. "Improvements in electro-magnetic devices." J. M. BARR. (Date applied for under Patents Act, 1901, July 17th, 1905, being date of application in United States.) July 10th. (Complete.)

15,614. "Improvements in electro-magnetic devices." W. H. THOMPSON. (Date applied for under Patents Act, 1901, July 17th, 1905, being date of application in United States.) July 10th. (Complete.)

15,615. "Improvements in and relating to electrical signalling apparatus." A. W. SHARMAN and THE DE FOREST WIRELESS TELEGRAPH SYNDICATE, LTD. July 10th.

15,616. "Improvements in electrical signalling." J. N. MASKELYNE, jun., and THE DE FOREST WIRELESS TELEGRAPH SYNDICATE, LTD. July 10th.

15,653. "Improvements in brakes for electric tramway and like vehicles." G. A. TRUBE and O. H. BALDWIN. July 10th.

15,662. "Improvements in and relating to adjustable pendants for hanging electric lamps and the like." W. B. SCOTT. July 11th.

15,669. "Improved electrical multi-circuit switch." A. J. D. KRAUSE and H. BEVIS. July 11th.

15,682. "Improved electrical indicator and alarm for fire prevention and the like." H. GARSTANG. July 11th. (Complete.)

15,704. "Improvements in intercommunication telephone apparatus." THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., and R. F. HALL. July 11th.

15,711. "Improvements in windings for alternating current dynamo-electric machines." L. J. HUNT and THE SANDYCROFT FOUNDRY CO., LTD. July 11th.

15,725. "Improvements in brakes and indicating connections for electric trams and other vehicles." D. J. MORGAN. July 11th.

15,759. "Improvements in making insulators and non-conducting material for electrical work." J. C. BUTTERFIELD. July 12th.

15,784. "Time measuring device for telephone conversations." J. ROUNSEVILL and A. BILMS. July 12th. (Complete.)

15,785. "Improved connecting means for the pole plates of the individual cells of storage batteries." G. DREIHARDT. July 12th. (Complete.)

15,793. "Improvements in electro-magnetic self-propelling torpedoes." O. LUGO. July 11th.

15,818. "Process for obtaining metals from ores or furnace products in the electric furnace." K. KAISER. (Date applied for under Patents Act, 1901, July 19th, 1905, being date of application in Germany.) July 12th. (Complete.)

15,835. "Improvements in motor-operated electric switches." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 12th.

15,839. "Electric driving gear for machine tools and other machines." A. WICHLER and G. RENNERT. July 12th. (Complete.)

15,909. "Improvements in and relating to variable condensers." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and J. V. ST. PLETTS. July 13th.

15,910. "Improvements in electric sparking mechanism applicable especially for effecting ignition in internal combustion engines." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and E. PRIDDLE. July 13th.

15,915. "Improvements in electric incandescence lamps." W. NERNST and L. STROCKEM. July 13th. (Complete.)

15,937. "Improvements in switches for motor cycles." G. R. DIXON. July 14th.

15,983. "Device for actuating advertising apparatus in vehicles driven by electricity." E. VON PLANTA. (Date applied for under Patents Act, 1901, November 28th, 1905, being date of application in Switzerland.) July 14th. (Complete.)

15,984. "Improvements in and relating to systems of control of electric motor operated devices." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 14th.

15,985. "Improvements in electric resistance devices." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) July 14th.

15,988. "Improvements in the regulation of electric currents subject to large fluctuations of load." M. J. E. TILNEY. July 14th.

15,989. "Improvements in speed regulation of continuous-current electric motors." M. J. E. TILNEY. July 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

ELECTROLYTIC CELLS. E. A. Ashcroft. 5,648. March 17th.

ACCUMULATOR PLATES. A. Schanschieff. 11,654a. June 3rd. (Date applied for under Rule 5 Patents Rules 1905, December 4th, 1905.)

SYNCHRONOUS ALTERNATING ELECTRIC CURRENT DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) 11,703. June 3rd.

ELECTRICAL OZONISERS. C. A. Sahlstrom. 12,367. June 14th. (Date applied for under International Convention, June 21st, 1904.)

JUNCTION BOX FOR ELECTRIC CABLES. T. B. Reader. 12,473. June 16th.

DYNAMO-ELECTRIC MACHINERY. The Hon. C. A. Parsons. 13,108. June 24th.

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) 13,112. June 24th.

SPARKING COIL WITH MULTIPLE WINDING FOR IGNITION AND LIKE PURPOSES. Soc. d'Electricité "Nilmelior" and A. Michel. 14,959. July 20th.

MANUFACTURE OF ELECTRICAL RESISTANCES. C. Ruzicka. 16,631. August 10th.

ELECTRODES FOR SECONDARY BATTERIES. H. F. Joel. 17,238. August 25th.

ELECTRICAL TRACTORS. L. Gerard. 17,643. August 31st.

CONTRIVANCE FOR TRUING THE SURFACES OF COMMUTATORS. E. B. Phillips and T. C. Parkin. 18,208. September 8th.

ELECTRIC MOTOR STARTING AND CONTROLLING SWITCHES. British Thomson-Houston Co. (General Electric Co.) 18,447. September 12th.

ELECTRIC CONTROL SYSTEMS. Allgemeine Elektricitäts-Ges. 18,519. September 13th. (Date applied for under International Convention, September 13th, 1904.)

ARC LAMPS. F. Janecek. 25,257. December 5th.

ELECTRICAL WINDING DEVICE FOR CLOCKS. A. H. W. Trilke. 25,356. December 6th.

ELECTRIC FUSE AND SWITCH MECHANISM. Callender's Cable and Construction Co. and J. C. A. Ward. 25,614. December 8th.

AUTOMATIC ELECTRIC CUT-OUTS. O. Imray. (J. A. Hoffe, Cape Colony.) 26,601. December 20th.

DYNAMO-ELECTRIC MACHINES. E. Porsche and L. Lohner. 27,152. December 29th.

APPARATUS FOR INDICATING WHEN THE TROLLEY-STANDARDS OF ELECTRICALLY-DRIVEN VEHICLES BECOME "ALIVE" AND FOR GUARDING THE STANDARDS WHEN IN SUCH A CONDITION. P. J. Pringle. 6,07. March 22nd.

DYNAMOS FOR RAILWAY TRAIN LIGHTING. H. Leitner and R. N. Lucas. 12,945. June 22nd.

COMBINATION INCANDESCENT ELECTRIC LAMP AND PERIODIC AUTOMATIC SWITCH FOR ELECTRIC FLASH LIGHT PURPOSES. C. H. Birkbeck. (Phelps Co.) 13,156. June 26th.

ELECTRIC LAMPS OF THE CHARACTER KNOWN AS VAPOUR LAMPS, IN PART APPLICABLE TO OTHER ELECTRIC VAPOUR APPARATUS. C. O. Bastian and G. Calvert. 13,158. June 26th.

ELECTRIC INCANCESCENT LAMP SOCKETS. W. Fairweather. (Benjamin Electric Manufacturing Co.) 13,424. June 29th.

ACCUMULATOR GRIDS AND MOULDS THEREFOR. Harry W. Cox, Ltd., and A. C. Mitchard. 13,471. June 29th.

ALTERNATING CURRENT ELECTRICITY METERS. W. Hamilton and Ferranti, Ltd. 13,696. July 3rd.

APPARATUS FOR AGITATING ELECTROLYTIC SOLUTIONS. F. J. Clarke. 17,152. August 24th.

ELECTRIC TERMINAL. O. Millauro. 18,673a. (Date applied for under Rule 5, Patents Rules 1905, September 15th, 1905.)

CONTROL OF ELECTRIC MOTORS. British Thomson-Houston Co. (General Electric Co.) 18,846. September 18th.

ELECTRIC SWITCHES. G. Smith. 18,904. September 19th.

ELECTRIC INCANDESCENT LAMPS AND FITTINGS THEREFOR. A. W. Hill and Sir Hiram Maxim Electrical Co. 19,259. September 23rd.

ARC LAMP ELECTRODES. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 20,330. October 9th.

TELEGRAPH AND LIKE POLES OR MASTS. W. Schutz. 20,501. October 10th.

ELECTRICAL FUSE BOXES. W. T. Henley's Telegraph Works Co. and W. H. Nichols. 21,648. October 24th.

JUNCTION BOX FOR ELECTRIC CABLES. E. W. Hill. 23,756. November 18th.

ELECTRIC INCANDESCENT LAMPS OF THE "NERNST" TYPE. G. K. Hartung. 26,987. December 27th.

1906.

WIRELESS TELEGRAPH SYSTEMS. C. G. G. Braunerhjelm. 2,194. January 29th. (Date applied for under International Convention, February 3rd, 1905.)

INTRODUCTION OF ELECTRICAL APPARATUS HAVING MAGNETIC CORES OR MASSES INTO ALTERNATING CURRENT CIRCUITS. Siemens Bros. & Co. (Siemens Schuckertwerke Ges.) 2,707. February 3rd.

REGULATING DEVICES FOR ARC LAMPS. F. W. Howorth. (Phœnix Electrotechnische Ges.) 3,212. February 9th.

INCANDESCENT ELECTRIC LAMPS. W. R. Lake. (Parker Clark Electric Co.) 3,890. February 16th.

ELECTRIC HORN. L. Chalas, E. Requillart and C. Contal. 4,931. February 28th. (Date applied for under International Convention, March 3rd, 1905.)

METHOD OF OPERATING FLY-WHEEL MOTOR-GENERATORS. Allgemeine Elektricitäts-Ges. 5,250. March 3rd. (Date applied for under International Convention, May 24th, 1905.)

SPARKING PLUGS FOR INTERNAL COMBUSTION ENGINES. P. Duflos. 5,566. March 7th.

ELECTRIC INSULATORS. E. J. Foreman. 6,317. March 15th. (Date applied for under International Convention, March 16th, 1905.)

ELECTRIC SPARKING PLUGS FOR EXPLOSION ENGINES. E. Canedy. 6,423. March 16th. (Date applied for under International Convention, March 16th, 1905.)

PROCESS AND APPARATUS FOR BUILDING COMPOSITE MICA PLATES FOR ELECTRIC INSULATION AND OTHER PURPOSES. B. G. Levis. 6,400. March 16th.

THERMO-CHEMICAL GENERATOR OF ELECTRICITY. L. P. Basset. 7,375. March 27th. (Date applied for under International Convention, March 27th, 1905.)

ELECTRICALLY HEATED SHAFT FURNACES. Allmanna Svenska Elektriska Aktiebolaget. 7,597. March 29th. (Date applied for under International Convention, March 30th, 1905.)

ELECTRICALLY HEATED SHAFT FURNACES. Allmanna Svenska Elektriska Aktiebolaget. 7,598. March 29th. (Date applied for under International Convention, March 30th, 1905.)